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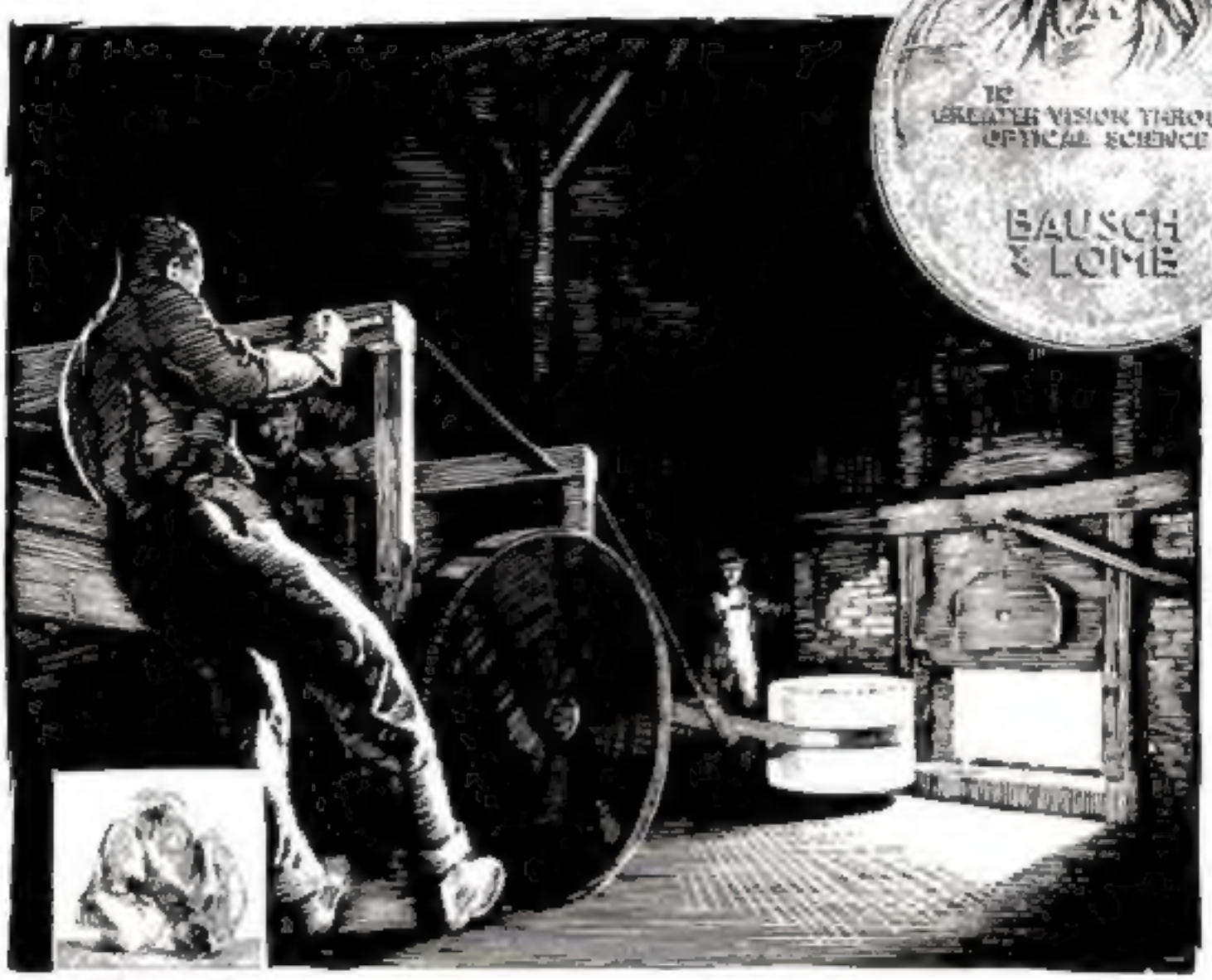

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VICTROLA

Victor Talking Machine Co., Camden, N. J.

Popular Science Monthly

FEB., 1920

Volume 96-No. 2

Better Subscribe Now

EVERYTHING that goes into the making of a magazine has more than doubled in price in the past two or three years. It is to help meet this situation that the POPULAR SCIENCE MONTHLY with this issue becomes twenty-five cents a copy. And on February first the subscription price will become $3 a year. Until then the subscription price will remain $2 a year, or $4 for two years. Canadian postage 50 cents. Foreign postage $1.

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(Continued on page 9)

POPULAR SCIENCE MONTHLY is issued monthly. Yearly subscription in the United States, $3.00. Canada, $3.50. Foreign, $4.00. Single copy, 25 cents.

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H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer.

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A Startling Memory Feat That You Can Do

How I learned the secret in one evening. It has helped me every day

WHEN my old friend Faulkner invited me to a dinner party at his house, I little thought it would be the direct means of getting me a one-hundred-and-fifty per cent increase in salary. Yet it was, and here is the way it all came about.

Toward the close of the evening things began to drag a bit, as they often do at parties. Finally some one suggested the old idea of having everyone do a "stunt." Some sang, others forced weird sounds out of the piano, recited, told stories, and so on.

Then it came to Macdonald's turn. He was a quiet sort of chap, with an air about him that reminded one of the old saying that "still waters run deep." He said he had a simple "stunt" which he hoped we would like. He selected me to assist him. First he asked to be blindfolded securely to prove there was no trickery in it. Those present were to call out twenty-five numbers of three figures each, such as 161, 249, and so on. He asked me to write down the numbers as they were called.

This was done. Macdonald then astounded everyone by repeating the entire list of twenty-five numbers backwards and forwards. Then he asked people to request numbers by positions, such as the eighth number called, the fourth number, and so on. Instantly he repeated back the exact number in the position called. He did this with the entire list—over and over again, without making a single mistake.

Then Macdonald asked that a deck of cards be shuffled and called out to him in their order. This was done. Still blindfolded, he instantly named the cards in their order backwards and forwards. And then to further amaze us, he gave us the number of any card counting from the top, or the card for any number.

You may well imagine our amazement at Macdonald's remarkable feat. You naturally expect to see a thing of this sort on the stage, even then you look upon it as a trick. But to see it done by an everyday business man, in plain view of everyone, blindfolded and under conditions which make trickery impossible, is astonishing, to say the least.

* * * * *

ON the way home that night I asked Macdonald how it was done. He said there was really nothing to it—simply a memory feat, the key to which anyone could easily learn in one evening. Then he told me that the reason most people have bad memories is because they leave memory development to chance. Anyone could do what he had done, and develop a good memory, he said, by following a few simple rules. And then he told me exactly how to do it. At the time I little thought that evening would prove to be one of the most eventful in my life, but such it proved to be.

What Macdonald told me I took to heart. In one evening I made remarkable strides toward improving my memory and it was but a question of days before I learned to do exactly what he had done. At first I amused myself with my new-found ability by amazing people at parties. My "memory feat," as my friends called it, surely made a hit. Everyone was talking about it, and I was showered with invitations for all sorts of affairs. If anyone were to ask me how quickly to develop social popularity, I would tell him to learn my memory "feat"—but that is apart from what I want to tell you.

The most gratifying thing about the improvement of my memory was the remarkable way it helped me in business. Much to my surprise I discovered that my memory training had literally put a razor edge on my brain. My brain had become clearer, quicker, keener. I felt that I was fast acquiring that mental grasp and alertness I had so often admired in men who were spoken of as "wonders" and "geniuses."

The next thing I noticed was a marked improvement in my conversational powers. Formerly my talk was halting and disconnected. I never could think of things to say until the conversation was over. And then, when it was too late, I would always think of apt and striking things I "might have said." But now I can think like a flash. When I am talking I never have to hesitate for the right word, the right expression or the right thing to say. It seems that all I have to do is to start to talk instantly I find myself saying the very thing I want to say to make the greatest impression on people.

It wasn't long before my newfound ability to remember things and to say the right thing at the right time attracted the attention of our president. He got in the habit of calling me in whenever he wanted facts about the business. As he expressed himself to me, "You can always tell me instantly what I want to know, while the other fellows annoy me by dodging out of the office and saying 'I'll look it up.'"

* * * * *

I FOUND that my ability to remember helped me wonderfully in dealing with other people, particularly in committee meetings. When a discussion opens up the man who can back up his statements quickly with a string of definite facts and figures usually dominates the others. Time and time again I have won people to my way of thinking simply because I could instantly recall facts and figures. While I'm proud of my triumphs in this respect, I often feel sorry for the ill-at-ease look of the other men who cannot hold up their end in the argument because they cannot recall facts instantly. It seems as though I never forget anything. Every fact I ever put in my mind is as clear and as easy to recall instantly as though it were written before me in plain black and white.

We all hear a lot about the importance of sound judgment. People who ought to know say that a man cannot begin to exercise sound judgment until he is forty to fifty years of age. But I have disproved all that. I have found that sound judgment is nothing more than the ability to weigh and judge facts in their relation to each other. Memory is the basis of sound judgment. I am only thirty-two, but many times I have been complimented on having the judgment of a man of forty-five. I take no personal credit for this—it is all due to the way I trained my memory.

THESE are only a few of the hundreds of ways I have profited by my trained memory. No longer do I suffer the humiliation of meeting men I know and not being able to recall their names. The moment I see a man his name flashes to my mind, together with a string of facts about him. I always liked to read but usually forgot most of it. Now I find it easy to recall what I have read. Another surprising thing is that I can now master a subject in considerably less time than before. I can then, marked quotations, data of all kinds, I can recall in detail almost at will. I rarely make a mistake.

My vocabulary, too, has increased wonderfully. Whenever I see a striking word or expression, I at once relax it and use it in my dictating or conversation. This has put a remarkable sparkle and pulling power into my conversation and business letters. And the very best part of it all is that I can now do my day's work quicker, and with much less effort, simply because my mind works like a flash and I do not have to keep stopping to look things up.

All this is extremely satisfying to me, of course. But the best part of it all is that since my memory power first attracted the attention of our president, my salary has steadily been increased. Today it is many times greater than it was the day Macdonald put me interested in improving my memory.

* * * * *

WHAT Macdonald told me that eventful evening was this: "Get the Roth Memory Course." I did. That is how I learned to do all the remarkable things I have told you about. The publishers of the Roth Memory Course—the Independent Corporation—are so confident that it will also show you how to develop a fine memory that they will gladly send the Course to you on approval.

You need not pay a single penny until you have examined the Course and found that it fully lives up to all the claims made for it. Send no money. Merely mail the coupon or write a letter, and the complete Course will be sent to you instantly, all charges prepaid. If after examination you decide that you do not want to keep the Course, then return it and you will owe nothing. On the other hand if you find, as thousands of others have found, that the Roth Memory Course will do wonders for you, then merely send five dollars in full payment.

You have always wanted a good memory. Now you can have it. Remember, you pay no money until you have proved that the Course will benefit you. You have everything to gain and nothing to lose by taking immediate action. So mail the coupon NOW before this liberal offer is withdrawn.

FREE EXAMINATION COUPON

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Publishers of The Independent Weekly
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Name .....

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..... Pop. Science. 2-20.

Popular Science Monthly

FEB., 1920

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MOTOR VEHICLES AND ACCESSORIES

NATURAL SCIENCE

PICTORIAL PAGES

RAILWAYS

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How a Failure for Eleven Years Became an $8000 a Year Salesman

"A single idea I consider responsible for my success—that the big pay goes to the men in the selling side of business."

He thought he had reached the limit of his advancement—but by shifting to sales work he more than quadrupled his salary, in less than three years. The following account of Fred MacClaren's experience is typical of successes being won by thousands in the selling field today.

By JAMES ALLISON

WHEN Fred MacClaren went out on the road as salesman for the B—— Corporation, there wasn't a fellow in the office who had any idea he would make good. That was several years ago, and I was only an office cub then—but I remember well the scepticism as to Mac's success. Mac had been a stockroom foreman for going on eleven years—a likable sort of fellow, but not the kind that one would ever imagine making a big success for himself.

Yet that is exactly what Mac did. He made good in sales work right from the start, and inside of eighteen months was outselling our veteran salesmen. And hardly a year later, when Jenkins, our Sales Manager, was hired away from us by a competitive company, the General Manager pulled Mac off the road and planted him in the private office up front as Sales Manager. I don't know what kind of salary proposition they made him for the new position, but while he was still on the road, his salary and commission checks went through my department, and considering the fact that he was making from $150 to $180 a week as salesman, I imagine they must have made the Sales Manager's job look pretty attractive to get him to accept it.

Mac's Sudden Success was the Sensation of the Office

Of course, everyone around the place thought Mac just plain every-day lucky—but I knew there must be something more than luck responsible for such a turn of fortune. I knew Mac well enough to know that he could have stayed in the stock room till he was retired on a pension and never have been raised above $35 a week. And yet—without showing a particular aptitude for salesmanship, he had gone into the selling field and achieved a striking success. Those days I was pretty much concerned about how I was coming along myself—I had been a bookkeeper with the B— Corporation for three years and was only making $27.50 a week. So one day I side-tracked Mac as he was passing my desk and told him I had something I wanted to talk over with him and wondered if he would take lunch with me some noon. Mac agreed—so a couple of noons later found us together at the Reynolds cafe.

I told Mac frankly what I was thinking about—how some of the men said he was born lucky—how others thought he had discovered some success secret—and went on to tell him of my own troubles and my desire to profit by his experience. Mac chuckled at the idea that his rapid rise was being attributed to the discovery of a success secret.

"There really isn't any secret about it," was Mac's simple assertion, "if you're interested I don't mind telling you the whole story.

"I simply got to the point where I couldn't see anything but a blank wall ahead of me as a stockroom foreman—I needed to make more money, and if $30 a week was all I was worth after eleven years, I figured it was up to me to get into a better paying line of work. It was at this point that I stumbled onto the idea that I consider responsible for my success. *The big pay goes to the men in the selling side of business.*

Why Highest Salaries are Paid Salesmen

"I looked around me at the successful men I knew, and it came upon me like a flash that practically every one of them was identified with some form of selling. And it is only natural that this should be so.

"There is a good reason why the same ability will command a larger income in the selling end of business than in the other departments. The men in the shop making the goods—and the men in the office handling routine accounts and credits—can never be as vital to a business as the men out selling—whose efforts actually determine how much goods shall be made. The payroll figures of any large concern will bear out the truth of this situation.

"But the thing which really decided me on becoming a salesman was an advertisement in a copy of System I happened to pick up. This advertisement described the service being rendered by the National Salesmen's Training Association—and a service which seemed to be exactly what I was looking for. The N. S. T. A.—as it is commonly known—is an organization of top-notch salesmen formed for the express purpose of training men for positions as city or traveling salesmen. A further service rendered to members of the association is its Free Employment Bureau that helps its members find the kind of job for which they are best fitted. I found the course of training of the N.S.T.A. to be just what I needed. There is nothing mysterious about it—it teaches you how to prepare the "Selling Talk"—how to approach the prospect—how to manage the interview—how to close the sale. In fact, it makes all of the processes of salesmanship so simple that it is hard to imagine how anyone could fail to become a good salesman by following the principles they outline.

"And besides finding better pay in sales work, I found a lot of satisfaction in having a job that enabled me to travel on the best trains—stop at the finest hotels—to meet new people daily."

How Mac Became a Star Salesman

"But the most practical feature of their course is the fact that it helps ability to opportunity and lets you to earn while you learn. To wind up a long story in a few words, I arranged with Jenkins, who was our Sales Manager at that time, to transfer me to the sales force—and found myself able to swing the selling job right from the start—thanks to what I had learned from the N.S.T.A. course. And besides finding better pay in sales work, I found a lot of satisfaction in having a job that enabled me to travel on the best trains—stop at the finest hotels—to meet new people daily. If you really are serious about wanting to better yourself, my advice is that you investigate Salesmanship, and particularly what N.S.T.A. training can do for you. You have exactly the same opportunity to succeed as I had—in fact, I can see no reason why any average clerk, bookkeeper, printer, mechanic or farm boy should not do as well as I have. The N.S.T.A. trains you from the ground up—gives you a complete insight into selling methods—in your spare time—without making it necessary that you give up your present position until you are ready to begin selling—and then through its Employment Bureau you secure a good position."

* * * * * * *

Mac's story was an eye-opener for me. That very night I wrote the National Salesmen's Training Association for facts on the training he had told me about. I found their system for fitting men for the sales field even more valuable than Mac had pictured it. After a couple of months' preparation, I secured a selling position through their Employment Bureau with a local tea wholesaler. Of course, I haven't made the success Mac has yet, but my pay checks already are nearly several times what I was making as bookkeeper—and with N.S.T.A. training to back me up, I know I'm going to reach the $10,000 a year class before long.

"Opportunities in Selling"—A Book You Should Read.

My advice to every man seriously interested in getting ahead is to write the Association to mail you without cost their book describing the present opportunities offered by the sales field—explaining why the demand for salesmen always exceeds the supply—why the scarcity of salesmen is particularly acute right now—telling just how its Course will qualify you for any line of selling. Included with the book are letters from hundreds of other members of the Association, describing successes won, also a large list showing lines of business with openings for salesmen.

Mail coupon below or post card today—it may change your whole life. Address National Salesmen's Training Association, Dept. 15-B, Chicago, Ill., U. S. A.

National Salesmen's Training Ass'n.
Dept. 15-B, Chicago, Ill., U. S. A.

With no obligation on my part, please send me full information about the N. S. T. A. Training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name .....

Street .....

City ..... State .....

.....

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SPORTS AND PASTIMES

MISCELLANY

RADIOTELEGRAPHY AND TELEPHONY

PRACTICAL WORKERS

I Got a $10 Raise Today

Thousands of men have done what this man did. Hundreds are doing it every day. You can do it too. Your ambition is the only limit to the heights you can climb.

JUST think, Jane, it's only six weeks since I got those books from Chicago and here Johnson called me into his office today and said: "Ben, you'll find an extra ten spot in your envelope tonight. I recommended it to the office a week ago and I see it's gone through. It's coming to you, old man, and I'm mighty glad to see you get it. There's been a marked change in you and your work lately. In fact, you seem to be a different man entirely. Using your head now, I've figured. That's the stuff. Keep it up and there'll be another ten before long. Always remember that the boss is glad to pay the man who uses his head."

Do you remember the night you told me I ought to send the little coupon that brought the books? We were mighty discouraged then. My salary hadn't been increased for several years and with everything costing more and more each day it seemed like we never would get out of the hole. We can do it now, though, Jane. This extra money every week will buy all those things you and the kiddies need. Besides, we'll have a little left over to put away.

I can't help recalling, though, what Johnson said about using your head. Here I am, almost thirty-five. Always considered a good workman. I didn't think there was anything about my work that anyone could tell me. Those books not only proved how little I knew, but in six weeks they brought me an increase in salary. With all my years of experience I couldn't get that extra money 'till I got hold of the books. It certainly does pay to use your head. I'm going to keep right on with those books 'till I know everything that's in them. Another thing, I'm going to tell every young fellow in the shop what they did for me. Just think where we would be today, Jane, if I had gotten those books ten years ago.

Hit-or-Miss Experience Won't Do

There are a lot of fellows like Ben in this world today—smart, full of "pep" and good workmen. Somehow or another though, they don't get ahead. There's something lacking in them and it's only one thing—training. Training doesn't necessarily mean going to school. It doesn't mean hardships or sacrifices. Not in these days. Any man with an ordinary school education—any man who can read English—can train himself at home. It won't interfere with his work either. It takes spare time only.

How Do You Stand?

The size and growth of your pay-envelope during the past few years will tell you whether or not you are one of these men who need training. If your earning capacity has not kept pace with your wants and needs you do need training. Make up your mind right now to get it. Join in with the thousands of men all over these United States who are training themselves at home—Train for the bigger job you want and have never been able to get—Train for the bigger salary that present day conditions demand you get, but which you are not fitted to earn. Don't let another day pass before you begin to train your head as well as your hands.

Let This Society Help You

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All You Need to Realize Your Ambitions

Here is a list of these great home study books. They are printed on the very best book paper obtainable, in large, easy-to-read type with hundreds of pictures and bound in genuine American Morocco. All books are trimmed in gold. The original publication price was set by the society at $4.80 a volume, but later it was decided to sell the books in complete sets only at a very big cut from the original price, and on easy monthly payments. Any set will be sent for a week's free examination. No money is necessary.

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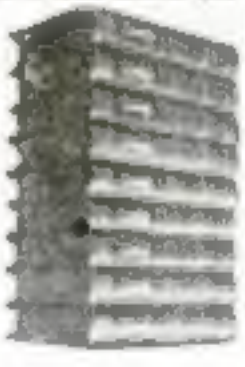

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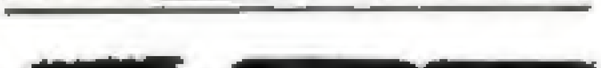

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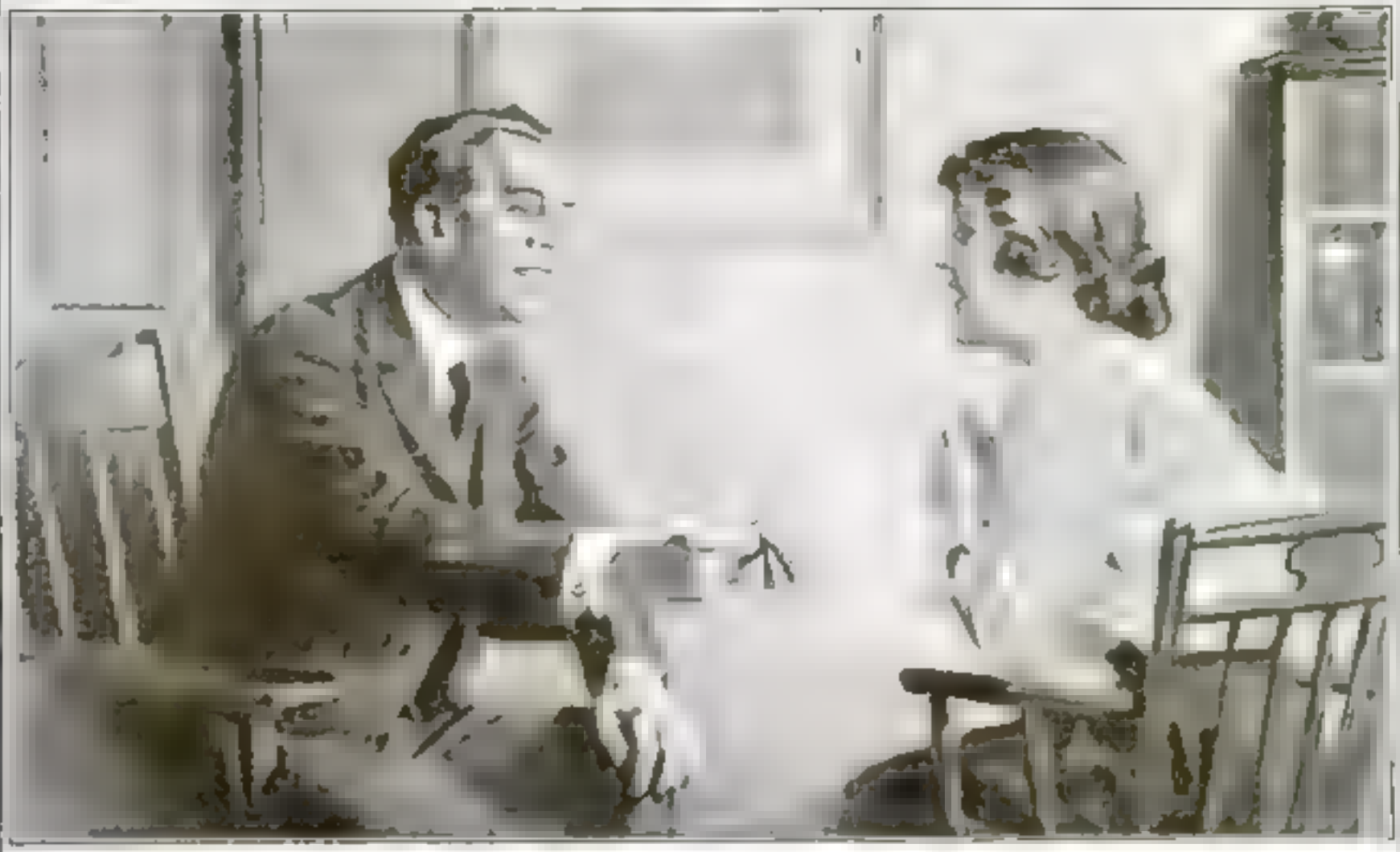

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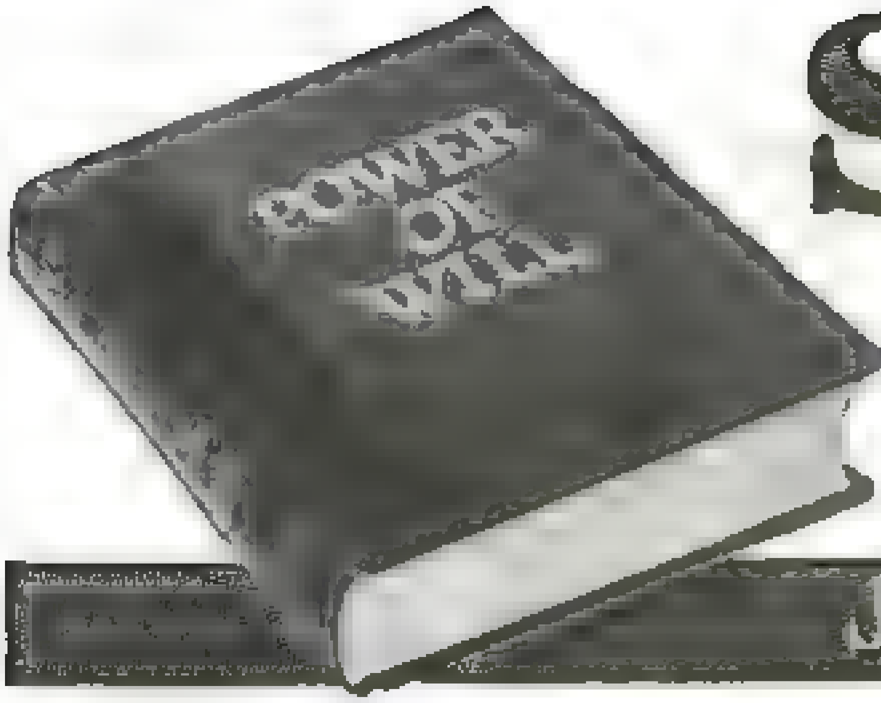

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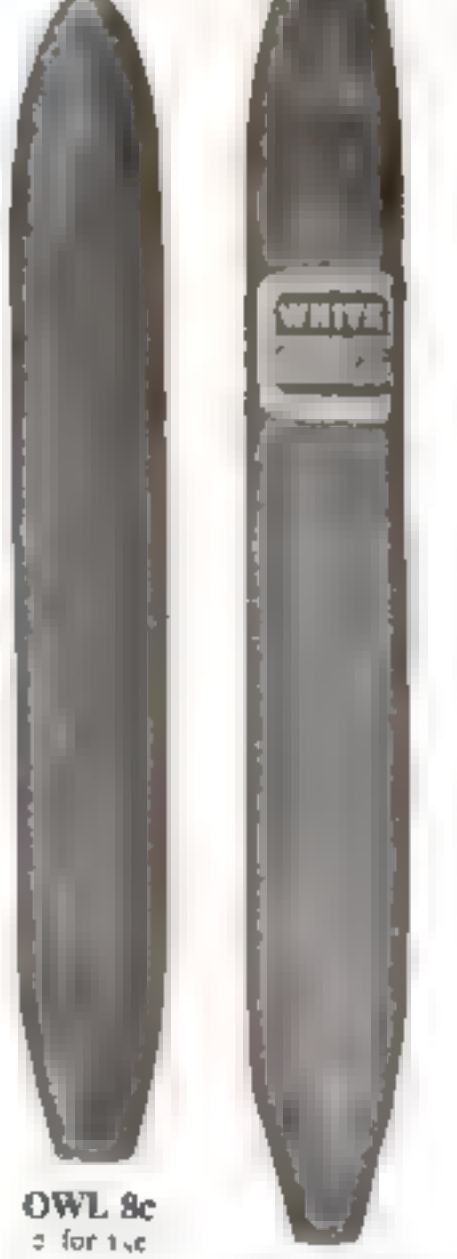

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Popular Science Monthly

Waldemar Kaempffert, *Editor*

February, 1920; Volume 96, No. 2
25 Cents; 3 Dollars a Year

Published in New York City at
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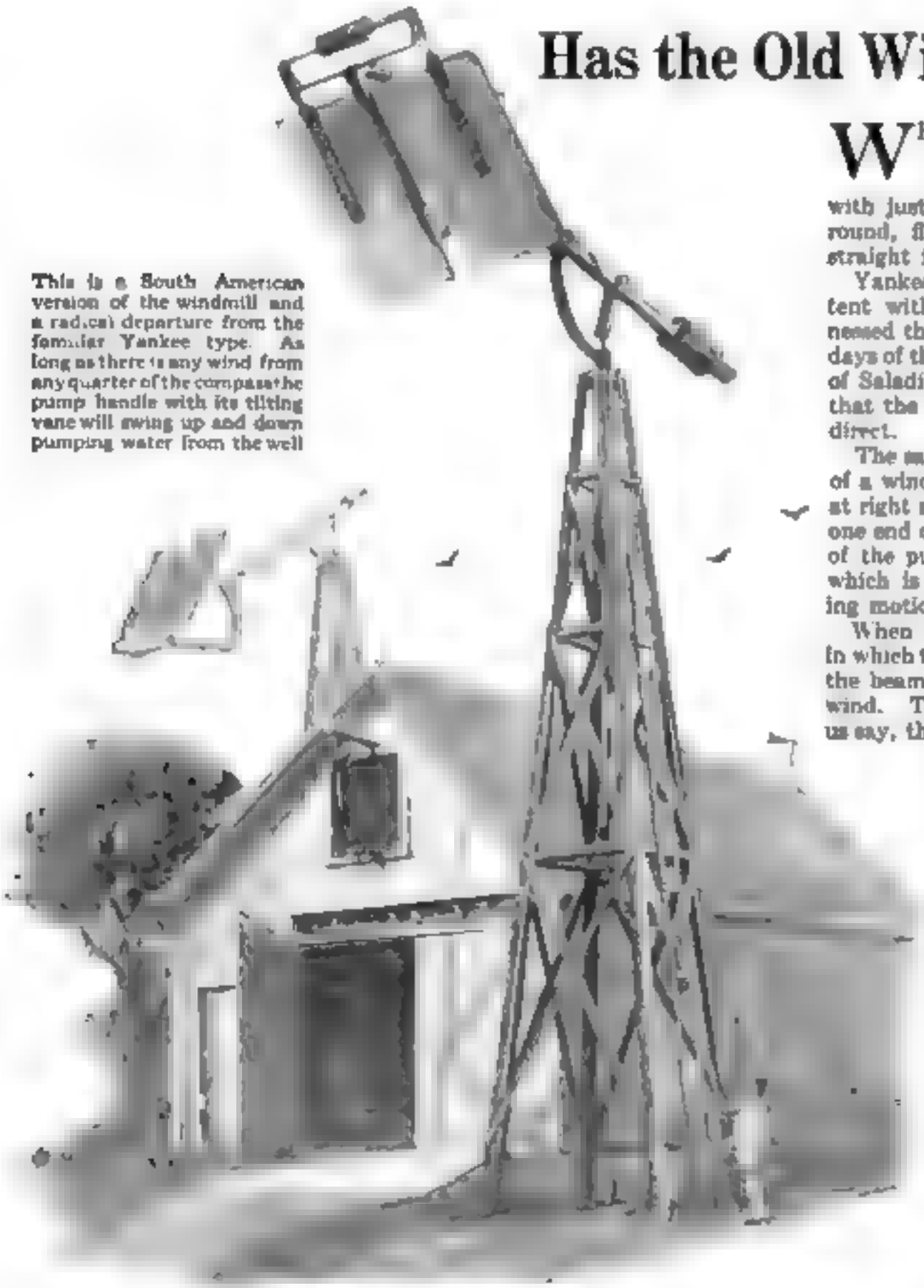
Has the Old Windmill a Rival?



This is a South American version of the windmill and a radical departure from the familiar Yankee type. As long as there is any wind from any quarter of the compass the pump handle with its tilting vane will swing up and down pumping water from the well

WHEN the wind blows, you have often seen the sails of a windmill go round. But have you ever seen a windmill with just one big sail which, instead of going round, flapped up and down? Here is one, straight from South America.

Yankees and Europeans have been content with the rotating fan which has harnessed the wind to the pump since the darkest days of the dark ages. But not so José Albiau of Saladillo, Argentine Republic. He insists that the wind supply him with pump action direct.

The sail of this South American conception of a windmill is a tilting vane, and is mounted at right angles to a triangular frame bolted to one end of a balanced beam. The piston-rod of the pump is also attached to this beam, which is capable of a rocking and of a rotating motion. Now for the action.

When the wind blows it strikes the frame in which the tilting vane is mounted and swings the beam into line with the direction of the wind. The wind then seizes the vane on, let us say, the upper face and tilts it against the lower limit of the frame. Immediately the wind pressure drives the beam down until this lower side of the triangle is parallel with the horizon and the face of the vane is no longer exposed to the wind. The full motion of the arm, however, extends one point further, owing to the excess momentum of the weight which balances the vane. This gives the wind a chance at the reverse, or lower, surface, and the vane is blown against the upper limit of the triangle and acts as a sail to lift the beam until this upper limit in turn takes the parallel position, the vane drops, and the beam is pressed downward again.

Meanwhile the piston-rod is worked up and down with the motion of the beam and is busily pumping water as long as there is any wind stirring.

This pullman car goes from factory to factory and gives the workmen lessons in first aid to the injured

First Aid Taught in a Pullman

A LARGE pullman car was run on to the side-track in the factory yard. A dozen laborers filed out of the factory and climbed into the pullman, taking seats along the sides. Going out for their daily airing? Not yet; the pullman was the Red Cross first-aid car that is touring the United States to instruct workmen in how to prevent accidents and how to take care of each other when accidents do happen

The picture above gives you an idea of what goes on in the Red Cross car. Two volunteer workmen are called for—one to play sick and the other to render first aid as prescribed by the instructor. The lesson lasts half an hour.

It has been estimated that the Red Cross pullman has already saved hundreds of lives.

Is Yellow Light Best?

RED, orange, yellow—are the colors from this end of the spectrum easier to look at than those from the other end? Is there anything back of the belief that a yellow light is less trying on the eyes than a bluish white light?

A recent issue of "Transactions of the American Illuminating Engineering Society" gives an account of several experiments to help determine whether there is any truth in the yellow theory. The results of these experiments tend to uphold the belief.

First, the people experimented on were given a three-hour eye efficiency test in a room lighted by the yellow glow of a kerosene-lamp. They read type, and when their eyes grew tired and the type began to blur, the time was noted. Later the same test was held in a room illuminated by a bluish white light. The intensity of illumination was the same in both cases, but the type blurred much more rapidly when read in the room with the blue-white light.

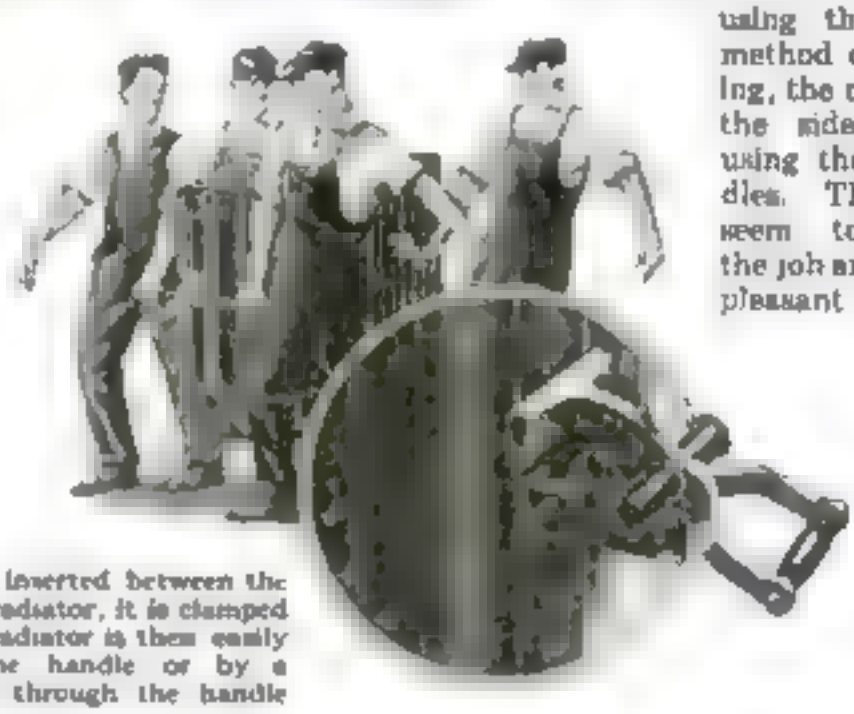
A more recent experiment was made in which mantles were filled with yellow fluids of different tints. It was found that the warmer the tint, the greater the efficiency of the eye.

The Radiator-Lifter

THOSE whose business involves lifting radiators, take note. And others also might just as well pay attention to this new radiator-lifter, for in these days you never know when you may be called upon to do your own little job of radiator-lifting. A radiator is a particularly awkward thing to handle, a fact which Mr. Edwin J Adamson of St. Cloud, Minn., recognized when he invented the lifter shown below

A T-head fits in between the pipes of the radiator and a clamp on the outside enables you to make it fast, so that it won't slip when it is forced to bear the weight of the radiator. There is a handle by means of which you may lift your end of the radiator and there is also an opening through which you may insert a bar, if you prefer.

The radiator shown in our illustration is a fortunate one; it has four attendants. The two men in front are using the bar method of lifting, the men at the sides are using the handles. They all seem to find the job an easy, pleasant one.



A T head is inserted between the pipes of the radiator, it is clamped tight. The radiator is then easily lifted by the handle or by a bar running through the handle

Cutting Steel Bars with Giant Scissors

WHEN the large steel ingot comes from the mold it still has a long way to go before it is ready to be manufactured into tools and other finished products.

It must first be rolled or forged down into bars or other suitable shapes.

With its great jaws the giant scissors easily bites in two a bar of steel six inches square It makes no difference whether the metal is hot or cold

The bars so formed are usually too long, and so they in turn must be cut into shorter lengths.

This is done in one of two ways—by means of revolving circular saws or by a machine that cuts like a pair of scissors. To saw such sections in two takes more time than to cut them. Therefore, where the thickness of the steel section will permit it, the scissors method is often used

Our illustration shows one of these huge scissors in use in a steel-mill. It takes two men to lift the bar which will be clipped in two like a match between the powerful jaws. Here the machine is cutting a section of cold steel about three or four inches square; but it is capable of cutting sections up to six inches square. It can penetrate with the same degree of ease either hot or cold metal

The machine is really two large castings of steel, one of which is stationary and the other movable by machinery on a pivot or arm at one end. Inserted on the edge of each of these castings, and held there by four or five bolts, are the two cutting edges proper, which are made of tool steel.

The cutting edges are made in such a way that they can readily be removed and sharpened whenever this becomes necessary.

The Machine with a Dipper that Digs and Dumps

THERE is a small machine that will march bravely up to a large pile of ore, dig right into it, and then fling great shovelfuls over its own head into a dump-car behind. Before very long the pile which looked so formidable will have disappeared. It takes only one man to operate the machine. He does it by means of three levers located at the side of the machine; these levers admit compressed air into three different cylinders.

The dipper of this machine will shovel a load of ore into the car behind; it is worked by compressed air

When the operator pulls the first lever the body of the machine shoots forward and a dipper in front is forced into the pile of ore; this is caused by the air being admitted into the lowest of the three cylinders.

When he pulls the second lever air is admitted into the middle cylinder and the dipper with its load is swung upward to a horizontal position. A pull on the third lever feeds air to the top cylinder and the dipper swings over completely to the dump-car behind. Its load emptied, the dipper goes back for more.

The body is mounted on trucks that can be adjusted to fit different tracks. Just above the place where trucks and body meet there are two concentric circular tracks on which the body can swing from side to side, thus allowing the dipper a large area to work in when in a fixed position. A gear-shift lever moves the body. The concentric tracks are placed in such a manner that the dipper will always drop its load in the middle of the dump-car.

The machine has an average capacity of forty-five tons an hour. It is so adjusted that when the dipper hits an immovable rock it will climb over it without any damage to itself

The machine has a wheel base of nineteen and one half inches and weighs two tons.

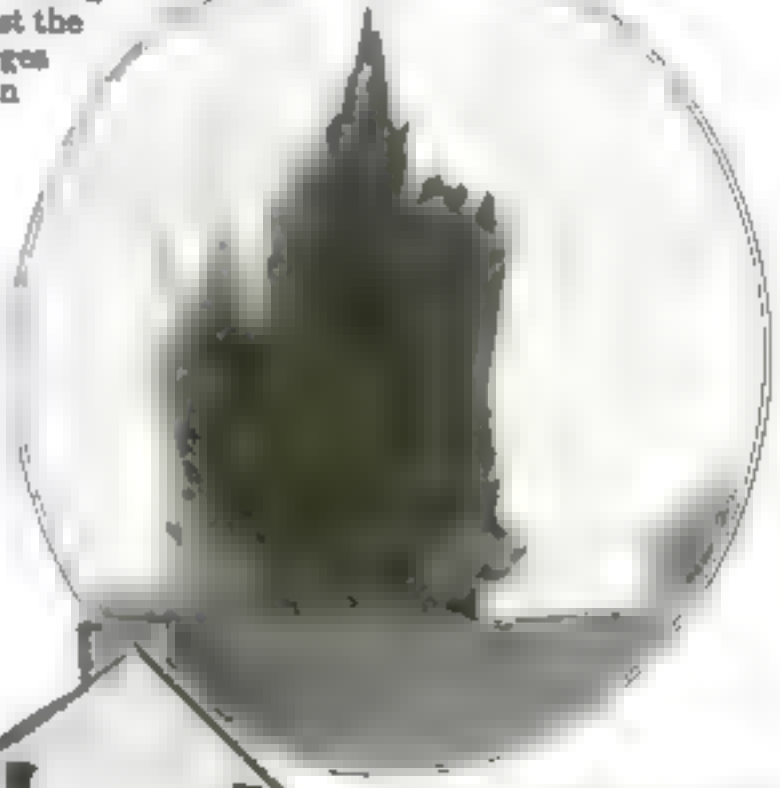
Don't Tear Down That Old House—Blow It Up

A quick, safe way to raze buildings

A HOUSE, dynamite, and a flame, mixed together in the proper proportions, will make a pile of debris. But what must the proportions be to insure the debris falling into one pile instead of scattering itself over the landscape? This problem was successfully solved by men who were called on to demolish a house as quickly and neatly as possible.

The house was a three-story stone one, very solidly built; it was not an easy house to raze.

After deciding to use dynamite the men working on the job figured out the exact spots at which they would have to place it. Three four-foot holes were dug along the two short sides of the house and four holes were dug along one long side. The other long side, which contained the most wood, was not touched. The holes were loaded with dynamite and an extra charge was placed in the cellar against the chimney. The dynamite charges were connected up with an electric blasting machine. When the blaster brought down the handle of the machine, wood, stone, and dirt flew into the air—the house was blown to pieces. And when the pieces settled down to earth again they landed in one small pile. The wood was burned and the stones were hauled away, and the whole job done within a few hours. The stone walls of this house were twenty inches thick.



Wood and stone flew vertically into the air and instead of scattering over the field came down in one big heap

How to convert the substantial house pictured on the right into this neat pile of wood and stone was the problem that confronted the wreckers

They looked the house over and decided that dynamite placed on three sides with an extra charge for the heavy chimney would do the trick

Is It Possible for the Railway

By cutting down wind resistance, one hundred

WIND resistance is the big factor in aviation. Not only does it retard airplanes, it also upholds them. It has to be created to make airplanes fly, and it has to be managed with great skill to make them fly well and fast. It is of importance for automobiles at racing speeds. The cars must have low seats, disk wheels without fenders, and a long conical tail in order to reduce the wind resistance. A closed car not at all streamlined, and presenting a front of, say, 48 square feet, would create a wind resistance at 80 miles per hour of $0.003 \times 48 \times 80^2 = 921.6$ pounds, to overcome which, at the 80 m.p.h., would require $\frac{921.6 \times 80}{375} = 196.80$ horsepower, in addition to the power needed for traction. At 40 m.p.h. the power required for overcoming the created wind resistance is only one eighth as large, or about 25 horsepower.

With these familiar facts in mind, many persons are inclined to apply the idea of streamlining to railway trains, and several propositions to this effect have been made. They have fallen on deaf ears. Are the railway authorities blind to their own interests? A brief examination of the conditions will show

Locomotives Built Since 1905

More locomotives have been built since 1905 than in the entire previous century. In none of them was any effort made to reduce wind resistance, although not a few were intended for speeds of 80 m.p.h. The locomotive is built with a frontage of from 100 to 150 square feet, composed of numerous irregularly projecting minor areas, and there are sharp corners and flat sides on the train it has to pull, all causing wind resistance. An engine at 80 m.p.h. clips a 70-mile head-wind at the rate of 150 m.p.h., and the wind resistance at this rate, if it were realized, would consume from 1,500 to 2,500 horsepower. Since the indicated horsepower of passenger locomotives ranges between the same figures, with few exceptions, nothing would be left for traction, and the actual result is that the train is slowed up at least 10 or 20 m.p.h.

The tractive effort of which locomotives in passenger service are capable has been increased since the year 1900 from 25,000 to 60,000 pounds. Average trainloads have increased from 410 to 700 tons. Maximum locomotive horsepowers have gone up from 1,400 to 2,800 for passenger trains. The much higher figures for freight and pusher engines need not be mentioned, since these types are not intended for the highest speeds. Taking 2,800 indicated horsepower as the maximum for a locomotive presenting a frontage of 125 square feet, one can figure loosely on the importance of wind resistance in the fastest normal railway operation now

Big Features Already Streamlined

One square foot of area held squarely to the wind resistance consumes 4.1 horsepower at 80 m.p.h., only 1.73 horsepower at 60 m.p.h., but 27 horsepower at 150 m.p.h. These figures give the keynote in the situation. Even if the frontal area of a railway train were erected squarely, however, at the front of the locomotive, the wind resistance at 80 m.p.h. would be much less than these figures indicate, owing to the elongated shape of the train. In point of fact, the largest cross-section comes at the cab, and the wind is split to a considerable extent by the cow-catcher, the buffer-bar, the high- and low-pressure cylinders, and the smoke-box. When one remembers that perfect streamlining of the whole train would reduce the wind resistance at high speeds to from one fiftieth down to one hundredth part of what it should be according to the cross-sectional area, and that the train, despite its angular ties, is better streamlined in its big features than any other big thing, excepting only a dirigible, an estimate of the horsepower really consumed cannot be placed higher than two horsepower to a square foot of cross-section. This makes a total of 250 horsepower at 80 m.p.h. But, on the same basis, the wind resistance at 150 m.p.h. consumes a little more than 2,000 horsepower.

The 250 horsepower constitutes less than ten per cent of the power employed, and to save more than half of this waste, reducing it to below five per cent, would require the most radical reconstruction and reshaping of every feature in the locomotive and the train. Railway engineers have much more obvious and plausible means at their disposal for saving five per cent of the fuel bills; and this explains their total indifference to the streamlining of railway trains. They have done a great deal in the past twenty years that virtually reduces the wind resistance factor by reducing its percentage of the total.

Locomotives and trains are much heavier than before, while their cross-section is very little larger. The

How a locomotive will look when railway speeds increase. Contrast its outline with that of the present type as shown in the broken away portion of the illustration

Train to Have Airplane Speed?

and fifty miles an hour is possible

If the railways are to meet airplane competition on a speed basis such modern monsters as this streamlined train will make their appearance. The streamlining is necessary to diminish the wind resistance, which becomes terrific at one hundred and fifty miles an hour

average power is more than doubled. Improved and lengthened fire-flue boilers, compounding, superheating, and increased boiler pressures have been the principal means employed. More than 7,000 of the 65,000 locomotives now in use in this country burn oil, but high oil prices are stopping this development. On the whole, the efficiency is enormously increased. Head-wind storms of from 40 to 50 m. p. h., which would have retarded passenger trains seriously fifteen or twenty years ago, are of no consequence with the new equipment.

The Dirigible Shows the Way

The matter changes completely when running speeds of from 80 to 150 m.p.h. are contemplated. A loss of 2,000 horsepower for wind resistance cannot be accepted. Either 80 m.p.h. must be taken as the natural limit for railway speed, or something radical must be done to cut down wind resistance. It is the mammoth dirigible that shows the way. For, with much larger cross-section than that of a locomotive and with much smaller power, it makes 70 m.p.h. A big seaplane, on the other hand, with its large exposed areas and need of sustentation, consumes 1,600 horsepower for wind resistance alone at a speed only slightly higher. The railway train must do better than the sea plane in this respect. And it can be made to do better, as it is similar in shape to the fuselage alone and can have plenty of power

There are only two difficulties: To make it stay on the tracks and to make it pay. They are enormous but perhaps not insuperable. When people begin to demand airplane speeds combined with railway carrying capacity, the demand can be met for passenger, mail, parcel, and perishable freight service operated with special locomotive and car equipment and over tracks that have all changes of grade and all curves located at the stations, where speed is reduced.

Asia, Africa, South America, and Australia will soon be bidding for new fast lines giving an opportunity for new construction of tracks and rolling stock without the immense handicap of the old construction on hand. Then it will be financially possible to reduce a wind resistance calling for 2,000 horsepower at 150 m.p.h. to many times less. The aerodynamical possibilities have already been demonstrated beyond controversy by the dirigible. The United States may jump into the lead with a transcontinental railway of this sort to beat the airplane.

The trains must be units, smooth as an eel from nose to tail. But even eels have gills. Dirigibles have their suspended cars, which break the outlines. The streamlined trains may still have the locomotive drive-wheels exposed just enough to facilitate inspection and oiling But the fronts must be remodeled. A buffer-bar will not be required. The cow-catcher will reach to the rails and will, in fact, sweep them. It may serve as a snow-plow, and may take care of straying elephants, buffaloes, and automobiles. As little air as possible should be permitted to pass under the train. The crude sand-box will be utterly discarded, being destructive of the supreme perfection of track and wheels. Headlight, smokestack, and domes will be lined up in one covered ridge.

The bell is already a mere traditional encumbrance. An alarm of automobile pattern can take its place. A periscope is better than an outlook to give a view of track and approaches. So the cab need be large enough only for the comfort of the engineer. The fuel should preferably be oil, and the tender can be made as high as the cab. The long fire-flue boiler could be made slightly conical (we have "conical" boilers now) or it may be tipped a few degrees forwardly.

How Streamlined Trains Will Look

In its outward lines the structure will resemble a big freight locomotive in reduced dimensions more than a passenger locomotive. It will have eight pairs of driving wheels in two sets, to get all the traction possible for its weight in all kinds of weather and to distribute weight and pounding over the precipitous track. It will have superheat but probably only single expansion on account of the speed wanted. The need of springs is due solely to roughness, grades, and curves of the track. When flexible bolts take their place, as used now in the boiler legs, the bodies of tender and cars can be lowered to within six inches of the rails. The wheel trucks can be dispensed with, the axles being mounted in the body with access from within; and the wheels can be removed from the outside for truing up.

The bearings will still be air-cooled. All airbrake apparatus can be enclosed in the false bottom of the cars, and may work on sheaves on the axles. The first car may be for mail and freight, the second for passengers, the third a baggage-car shaped for tailing off the streamline. The train may be made as long as the traffic justifies.

When the railway engineers, with their greater competence in all details, begin to dream and figure and design along these lines of thought, the railway train with airplane speed will not be far away.

When Cormorants Go Fishing for Their Masters

"CORMORANT [illegible] very much alike — that is, all cormorants are gourmands. The cormorant is a great black bird with webbed feet [illegible] the water and swallow all the [illegible] them all. Since [illegible] fish [illegible] it is often tamed [illegible] taught to return to its master with all the fish it has caught.

A strap is fastened around its throat when it goes fishing, so that it will not be able to swallow the catch. It keeps the fish in its flexible throat. Vulgarly spunking, it spits them out at its master's feet.

Has She the Longest Hair?

IT is said [illegible] hair grows the [illegible] shortest, while wavy hair holds an intermediate position.

However that may be, Miss Ethel Payne, an English girl, boasts of having the longest hair of any woman in the British Isles, although her hair is wavy—either by nature [illegible] A [illegible] fi[illegible] fa[illegible] he[illegible] wh[illegible] st[illegible] h[illegible] o[illegible]

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A Balcony Scene

THE clean, neat white grain-elevator in the picture above resembles a tipsy jack-in-the-box when reflected in the turbulent waters of the Mississippi. The balcony near the top when seen in the water looks [illegible] the image [illegible]

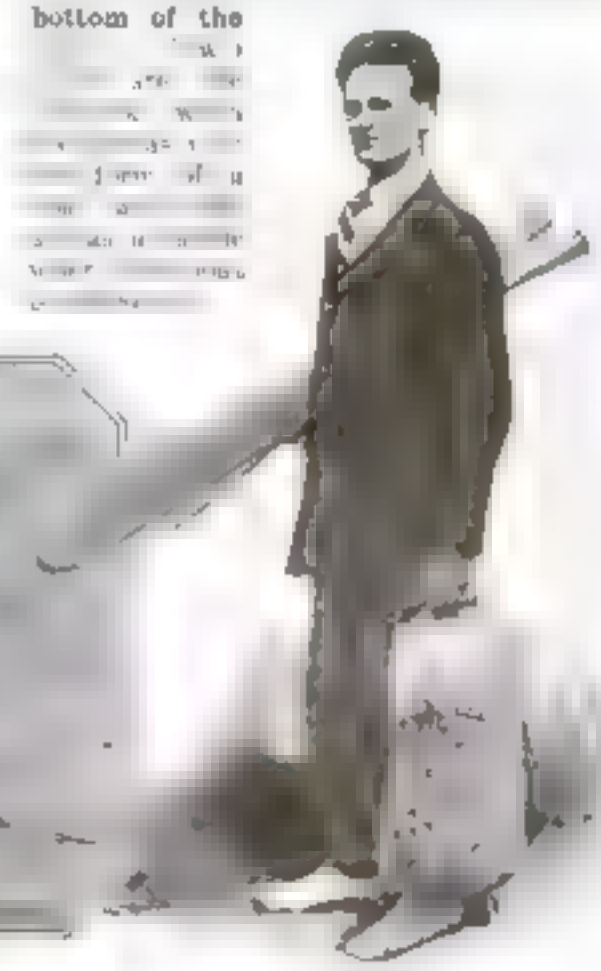
Beating the High Cost of Living in East Africa

W[illegible] James N Had[illegible] low in the picture. Mr. Haddock, an Englishman, made his catch off the East African coast. He calls the fish a kind of sea-bass. It weighed two hundred and fifty [illegible]

Fold Up Your Boat and Walk

AFTER all, a row-boat does not have to be made of wood. Mr. Swinburne, of [illegible] England, built a collapsible boat of canvas, and he is shown herewith both carrying it in his hand and rowing in it.

It is made in four compartments which, when blown up, form a square. A piece of canvas stretched across them acts as the bottom of the [illegible]



Smoking the Family Cigar

NOWADAYS, when the supply of tobacco is short and the price is long, so that, as someone recently said, you "can now get an excellent five-cent cigar for twenty-five cents,"—life in the Philippines has its attractions for the smoker.

We can't speak for the quality, but a glance at the picture above leaves no doubt in anybody's mind as to the quantity of the cigar in question. However, the young woman is not going to smoke this two-handed cigar all by herself. It is probably a family cigar.

Sometimes these huge cigars are suspended by a cord from the ceiling of the living-room, so that any one passing by can snatch a puff.

The Arch of Many Woods

THERE are about three thousand different kinds of wood in Canada, and they are all represented in the arch shown below. Some were gathered in the "bush," others in the arctic tundras, and many more in a dozen different mountain-ranges. The arch is located at the entrance to the exhibition grounds at Ottawa, and is really effective in spite of the many kinds and colors of the woods that make it up.

But, alas! the ticket-seller is a mercenary man who cares nothing for appearances: he has built his booth of common pine slabs and it stands alongside of the arch.

The arch is not purely ornamental: it has three turrets like observation towers from which visitors can get a general view of the exhibition grounds. There are stairs at each end of the arch, and a narrow path that extends from end to end. Thus it can be used as a bridge.

A Toolmaker Turns Sculptor

AFTER the fashion of Abou ben Adhem, William Rutter awoke one night from a deep dream of peace and visioned himself a great sculptor. He was a toolmaker by trade.

Early the next morning he went to the public library and borrowed "The Technique of Sculpture," returned home, and began to model busts with the help of a small penknife, some matches, and clay.

Mr. Rutter is shown above working on a bust of himself. Looking at the mirror and then at the bust, you are convinced that Mr. Rutter sees himself as others see him, but, musing on present-day labor wages, we advise him to stick to toolmaking.

Putting the Sea in Seaplane

THE seaplane, as its name implies, is a creature of air and water. It is, however, more at home in the lighter element, and often therefore comes to grief when it is forced to alight in the water in rough weather.

For this reason, more and more attention is being paid to the construction of the hulls of flying-boats. The photograph reproduced below shows one of the largest passenger-carrying seaplanes ever built. Her hull is of the sea-sled type.

Sea-sleds unencumbered by wings are almost unbelievably speedy—one designed for government use being credited with sixty miles an hour—and they are remarkably good sea-boats. With a hull of this type the seaplane lives up to the first part of its name.

It Simply Got Their Goat

UP to the present time the island of Guadaloupe has been a sort of goats' paradise. The goats had only to graze and bleat and butt to their hearts' content. Then nature butted into the goats' paradise. She turned off the rain and the vegetation dried up. While the goats could still butt and bleat, they could no longer graze. Now, goats feel that grazing is very necessary, and consequently life soon became unendurable.

In view of these happenings, they are emigrating, under supervision, to San Diego, Cal., where they will live in a decent domesticated fashion.

In the picture below we see some of them making the journey on the Mexican steamer *La Paz*.

Corrugated cardboard is poured between rows of wood blocks so that the block may expand in warm weather without buckling. Also the corrugations help to hold the pitch in place

Wood and Cardboard Paving

CORRUGATED cardboard!—what's it used for? Bundles, you say. That is its chief job, but it is also used in the gutter, as a spacer for wood block pavement. The corrugated cardboard is cut in strips and placed between the rows of wood blocks to allow for expansion in warm weather, and to act as a dam for the pitch. An old wood block pavement was full of waves and bumps. The blocks were taken up and a new bed of sand and cement was laid; the blocks were put back in rows with a layer of cardboard between them.

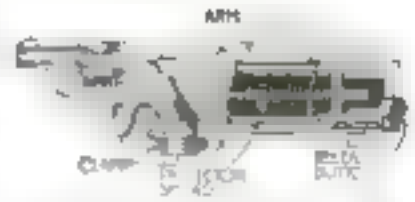
When the pitch was poured in, the corrugations dammed it up and kept it from running to the sides.

A Gun Up Your Sleeve

"HANDS up!" commands the masked train robber.

The hands are still going up when there is a sharp report and the highwayman collapses in the doorway.

Who fired the shot? A traveler coming from the West. When the hold-up man gave the command "Hands up!" the traveler pressed his right elbow against his hip. This released a spring, which caused a loaded revolver fastened to a clamp to slide forward along the two guide-rods strapped to the forearm. The gun and the projecting mechanism were within the man's coat sleeve. When he released the springs of the projector by pressing against the release button, the gun slipped out of the sleeve into the hand which was ready to receive the weapon. When the man deliberately raised his arm he pointed the gun at the robber and pulled the trigger before the hold-up man became aware of his danger.



This diagram shows the simple mechanism of the gun projector which is to be strapped to the forearm

A loaded gun that springs out of your sleeve as your hand goes up would be mighty handy in case of an attempted hold-up

Chopping Off Minutes and Saving Strength

LOOK at the pictures of the man with the wheelbarrow. In one of the barrows the weight of the load is much nearer the supporting wheel than in the other.

This increases the leverage so that with the same effort the man can carry from 100 to 150 pounds more coal each trip than he can when using the ill-balanced barrow.

The other pictures illustrate the difference between the right and wrong kind of shovel. In the shovel with the short, curved handle only sixteen pounds of coal can be lifted. Twenty-one and one half pounds can be lifted just as easily in the shovel with the long, straight handle.

With the short shovel and the wrong wheelbarrow one man can handle 45,000 pounds of coal in twelve hours. With the long-handled shovel and the right kind of barrow he can handle 65,000 pounds in eight hours with less fatigue.

This man is handicapped by a poorly balanced wheelbarrow. Note the short handle and the location of the wheel out from under the container

This man handles 65 000 pounds in eight hours with less fatigue than he could handle 45 000 pounds in twelve hours with the other wheelbarrow

Stooping low for every shovelful strains the back. The long-handled shovel saves strength and applies it to the weight of the load to be lifted

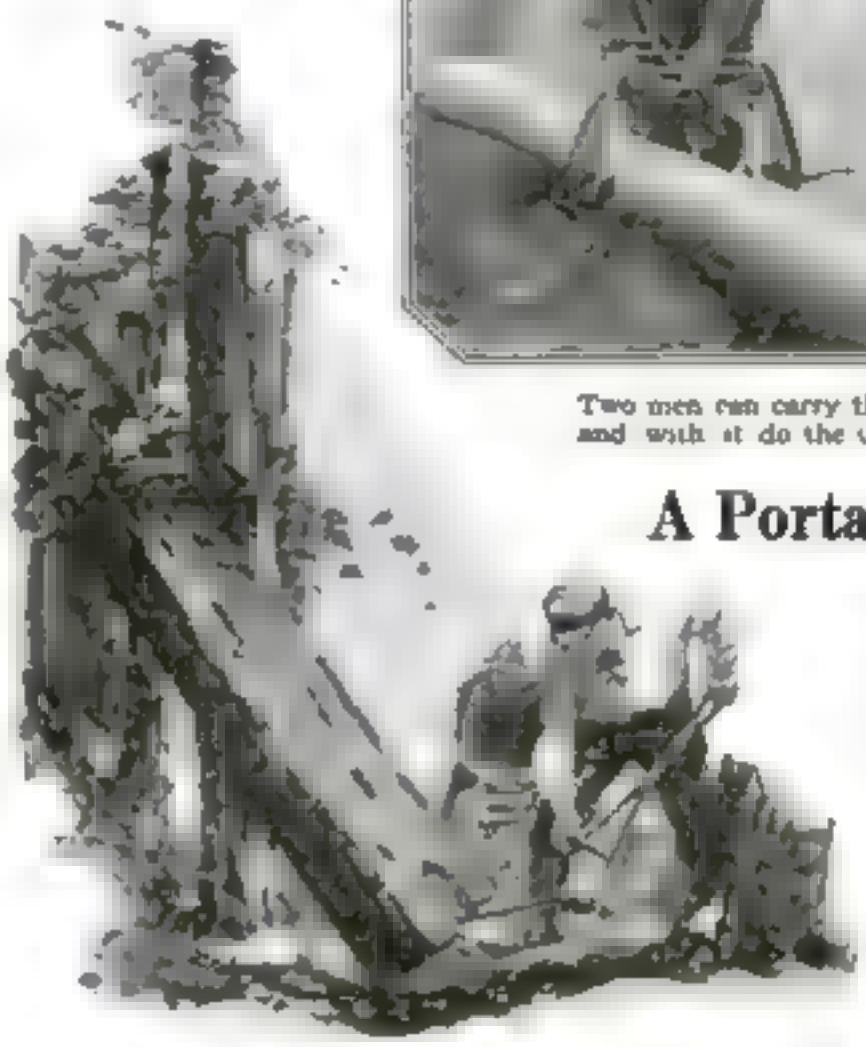
With this long handled shovel the capacity of the scoop can be increased from sixteen to twenty-one and a half pounds without increasing fatigue

A Remedy for Cold Feet

THE present generation is going to keep its toes warm when it goes skating. A toe-warmer has been invented which is a comfortable, snug-fitting toe-piece, made of soft leather. Some are made plain, and some have the natural fur left on. Sheepskin is recommended as an excellent material.

Think of the coziness of wearing a skating-shoe with a warm, woolly toe-piece. And how comforting it would be to those chunks of ice in the tonneau that used to be your feet. On a very cold day almost anybody, anywhere, would welcome this half-brother to the moccasin. Of course the shoes must be larger than those ordinarily worn.

Don't let cold feet spoil your sport. Dress up your feet in snug, woolly toe warmers—and this means especially you automobilists and skaters



With this saw trees may be cut almost level with the ground, which means a considerable saving of lumber

Two men can carry this power saw into the woods and with it do the usual work of a logging gang

A Portable Power Saw

ON a single day during the recent war, two German soldiers cut down five hundred pine and fir trees of an average diameter of one foot

How did they do it? They used a saw invented in the early part of the war by A. von Westfeld, a German engineer.

Instead of having a continuous ribbon-like blade, the saw is composed of chain links, similar to the drive chain of a bicycle. On their outer side the links of the chain have cutting teeth of extremely hard steel which will remain sharp for many weeks under continuous use. This endless blade is supported on four ball-bearing sprocket wheels mounted in a light metal frame shaped like the frame of a jeweler's saw.

The saw is driven by a small benzene engine with which it is connected by a flexible shaft. The engine has two cylinders, is capable of developing five horsepower, and is equipped with a muffler. It is cooled by air.

In view of the shortage of labor which makes itself felt acutely in the country districts of America as well as in Europe, a saw of this description would be highly useful for farmers and owners of timber-land. Only two men are required to operate and transport saw and engine and the quantity of fuel consumed by the engine is insignificantly small. The trees may be cut so close to the ground that the stumps left after the cutting are scarcely more than an inch or two in height and do not interfere with the use of vehicles in the cleared parts of the woods.

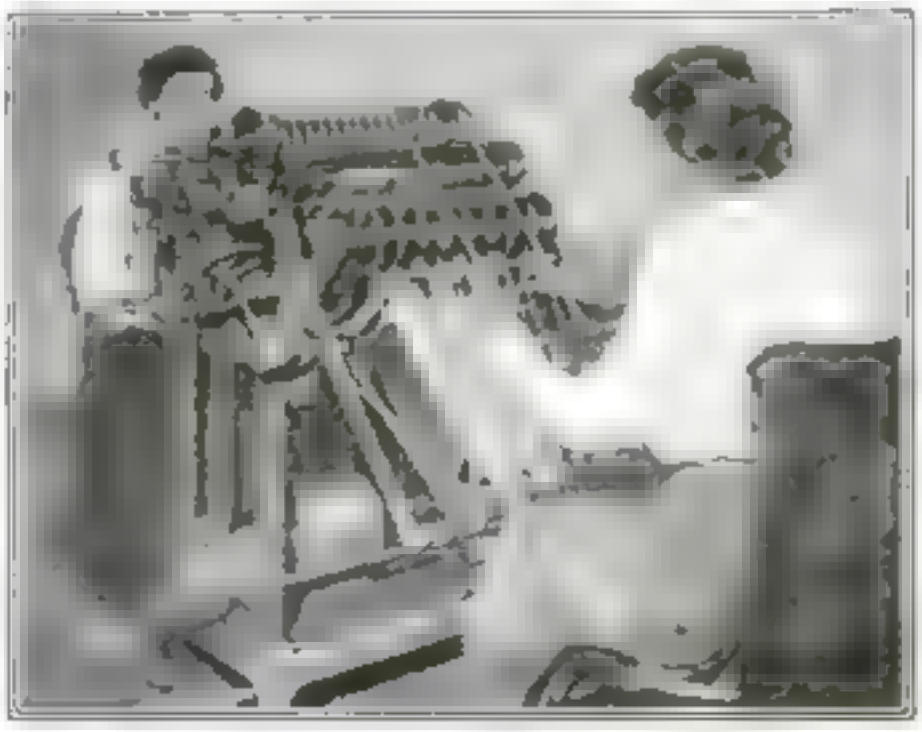
This saw may also be used to advantage for the cutting of firewood, at a great saving of both time and labor.

The Thrifty Thrift Stamp

THRIFT stamps practise what they preach. You who have bought them know how they come, in page formation with cross-line perforations separating them from one another. What becomes of the small paper circles that fall out when the perforations are punched? They are not thrown away, oh, no indeed. They are kept and sold by the barrelful to paper manufacturers. Such is the thrift displayed in the making of the thrift stamp.

Every day one billion three hundred and sixty-five million holes are punched in the United States Bureau of Printing and Engraving, and the small circles that drop out fill four barrels. The stamps are printed in sheets of four hundred, and each sheet contains ten thousand nine hundred and twenty perforations. The Bureau turns out one hundred and twenty-five thousand sheets each day. Do the multiplying yourself.

Threadbare money is also salvaged. It is boiled in water and soda-ash until it is reduced to a wet pulp, then sold to paper manufacturers. In one year the bureau sold nearly four million pounds of wet pulp and four hundred thousand pounds of shredded money.



Sheets of cigar stamps are now being run through the perforating-machine the small paper circles that drop out are kept and sold as paper stock

What the Wind Can Do

The frisky buggy wrapped itself around a pine-tree stump and stayed there but it needed the assistance of a cyclone in order to get there in the first place. The top of the tree was blown off and the barn directly behind it disappeared completely

In one minute a cyclone can do as much damage to a town as four years of bombardments. Doesn't [illegible] as we see the shape of [illegible] passed through by [illegible]

This junk heap was an automobile before the cyclone hit it the sides are battered in, the stuffings coming out, two unharmed tires are sitting in the back seat, and the engine has completely disappeared. Could an actual collision do more?

"Will you walk into my parlor?" said the cyclone to the tree—and the tree walked in along with several other uninvited guests. Who can doubt but that the cyclone owns the parlor now? No one else would claim it

Luxurious Trolleys

With mirrors and cushions for motormen, clocks and handrails for passengers, are the trolleys trying to compete with automobiles?

When the street-car company bought a mirror [illegible]

As the songsters would say, the [illegible] While the passengers [illegible] wooden [illegible] every [illegible] in the form of a deep [illegible] adjustable seat

The conductor's [illegible] one. He must make change rapidly and accurately and yet [illegible] the steps through without paying

Are street-cars trying to put automobiles out of business? Most automobiles have clocks, and now the trolley car is sporting one

Colored squares, triangles, and Maltese crosses make it easy for the citizens of Ottawa, Canada, to tell one trolley from another

There are plenty of seats, yet one man persists in standing. Perhaps he is trying out the new center rail that has recently been installed

When you finish looking at the lady in this picture, look at the store window behind her Down it a sheet of water pours constantly, attracting the attention of shoppers

Always Rain on the Window-Pane

"THE pipes have burst!" said one man to another as he pointed to a store window down which torrents of water were running. They rushed across to watch the excitement, but there was no excitement. The storekeeper acted as if nothing unusual were happening. The water continued to pour, but, curiously, it did not flood the floor of the window

The deluge was planned to attract attention. Inside this window it rains all day, regardless of the weather without. A perforated water-pipe is fastened along the window's upper edge and a cement trough for catching the water is grooved along the bottom.

Through an opening at one end the water runs off into a drain-pipe. The perforated pipe is connected with the pipes in the basement which furnish water throughout the building.

Put on Your Skates at Home

NUMBED fingers need no longer be among your troubles at skating parties. If you adopt the invention of Nathan Sadowsky, of New York, you can walk from your home to the pond with your skates already at ached.

The new device is practically an overshoe with a sole sufficiently thick to serve as a guard for the blade of the skate. The top fits the shoe, and is fastened in place by a toe-cap and a thong at the heel. The "sole" of the overshoe is made of cork, or other light material, with a deep groove down the middle to allow the skate blade to slip in to its full depth. To allow for variation in the blades, heel and toe are slit.

If you don't mind looking like a Celestial, or as though you had club feet, you can keep your fingers warm and add a cubit to your stature at the same time

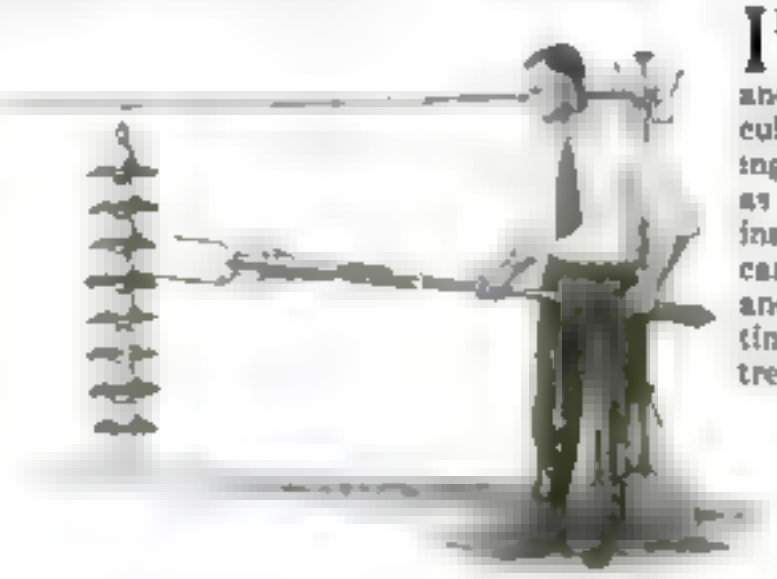
Does the Insulator Insulate?

IF the insulator is defective, it always means a loss of electric power and, in the case of a high-power circuit, great danger from short-circuiting the current. To prevent, as far as possible, such loss and danger, the insulators of high-power lines must be carefully tested before they are installed, and the tests must be repeated from time to time, especially during extremely hot weather

Insulators are usually made of porcelain and metal. Metal expands proportionately much more than porcelain, and in hot weather this expansion frequently breaks the porcelain

The accompanying picture shows the method of testing insulators for high-power circuits before they are put to use. After they have been put in service the insulators are tested in a like manner, but the current in the line must be shut off while testing. The long handle of the testing apparatus contains several dry cells, the current of which is in series with the low-tension windings of an automobile induction coil and a snap switch

The high-tension windings of the induction coil are directly connected across the two tines of the testing fork and are in series with an automobile spark-plug. Whenever the fork is placed across the metal parts of adjoining insulators, one or both of which are defective, there will be a discharge across the spark-gap. There will be no discharge if the insulators are in good condition.



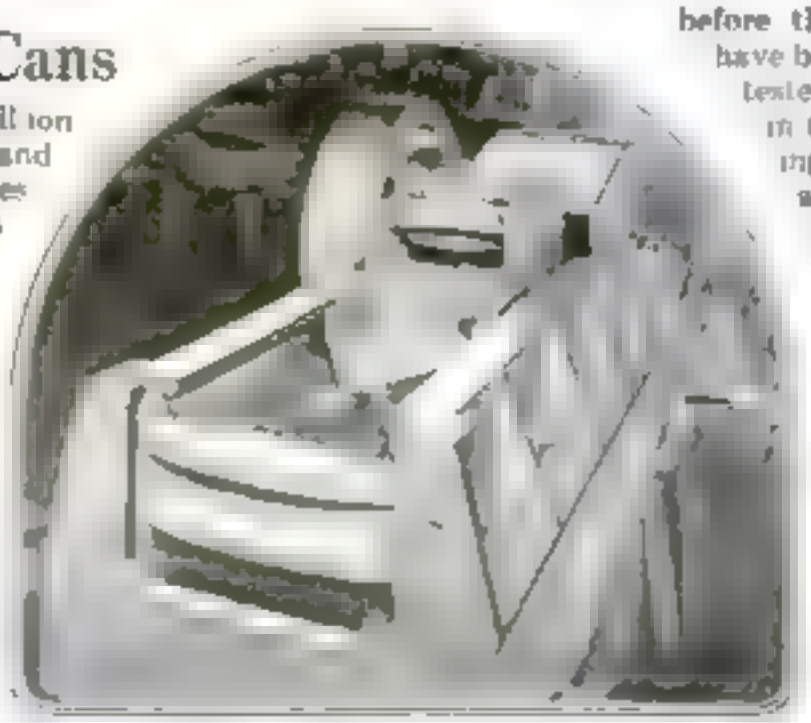
If one of the insulators is defective a discharge at the spark-gap of the testing fork will indicate it. Current is supplied from the handle

Rejuvenating Tin Cans

APPROXIMATELY two million cans are opened, emptied, and thrown away in the United States during a year. This represents eight hundred thousand tons of material—eight thousand tons of which is pure tin. And tin is valued at about sixty cents a pound.

The machine in the picture is putting up a good fight against such waste. It takes an old tin can, chops off its head, then chops off the base, slits it down the seam, and finally flattens it out so that it is once again in sheet form. The heads and bases are melted in an electric furnace and the tin reclaimed

The machine was invented by Thomas D. Miller of Maryland.



This machine will take an old tin can in its jaws, chop off top and bottom, slit it down the seam, and flatten it out

Don't Drop the Stove-Lid

THIS new stove-lid lifter consists of two handles with lifting hooks on the ends. The handles are clamped together near the hooks and, in a normal position, the two hooks become as one. These hooks are inserted into the lid and the handles are pressed together. The hooks then part until they hit the sides of the hole. A toothed ratchet attached to one handle near the upper end simultaneously passes through a slot in the other handle and locks it in place

To remove the lifter from the lid, move a lever that locks the blade, and the handles will spring back into their original position.

When you press the handles of this stove-lid lifter, you spread the hooks at the ends and the lid is held fast, with no possibility of slipping

Two All-Metal Airplanes

FRAILTY, thy name is not only woman, but airplane. An expert tells us this: "Today's airplane is soon fit for the scrap-heap even if it is merely kept in storage. What is the reason? The airplane is a wooden structure of exaggerated size and strength, and yet of minimum weight. The wood is kept under continuous strain even while the machine is idle, and it must retain a rigidly constant shape—a most difficult thing for wood to do under extreme weather conditions."

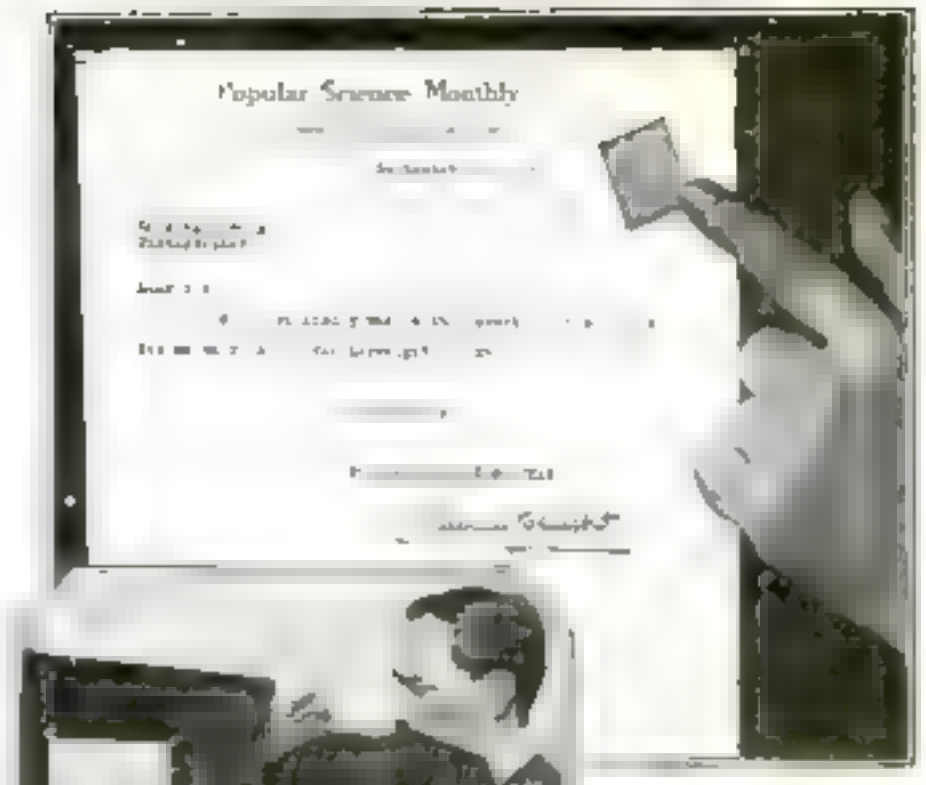
How about making airplanes of metal? Steel, for instance, would not be greatly affected by extreme weather conditions, and it is certainly strong enough to retain a rigidly constant shape. But steel has this drawback: it is too dense to stand the motor vibration to which it would be subjected. Steel and aluminum together—that seems to be the ideal combination for airplane construction. The two airplanes shown here are built on this principle; the *Bristol* is an English airplane and the *Berta*, needless to say, is a German one.

In the *Bristol* biplane, except for the propeller, there is not enough wood to make a match. The struts are of hollow steel, the spars in the wings are of steel, and the more jointed ribs of aluminum. The fuselage can be disassembled into several sections for transportation. It weighs no more than wooden airplanes

Berta, on the other hand, is a monoplane. The wings are thick, short, and are covered with corrugated aluminum sheeting. They are so strong that no outside bracing by wires was needed; power-wasting air resistance is thus eliminated. Inside the corrugated aluminum there is a complicated framework of steel and aluminum.

This English biplane is made of metal—steel and aluminum combined, the struts and spars are of steel and the more jointed ribs of aluminum the fuselage can be disassembled into several sections for transportation

Berta is a German all metal fire-proof monoplane the short, thick wings are covered with corrugated aluminum sheeting, making it unnecessary to use bracing wires



That small oblong in the upper right hand corner of the letter is not a stamp, but a film, to show how photography can reduce the weight of mail to go by air

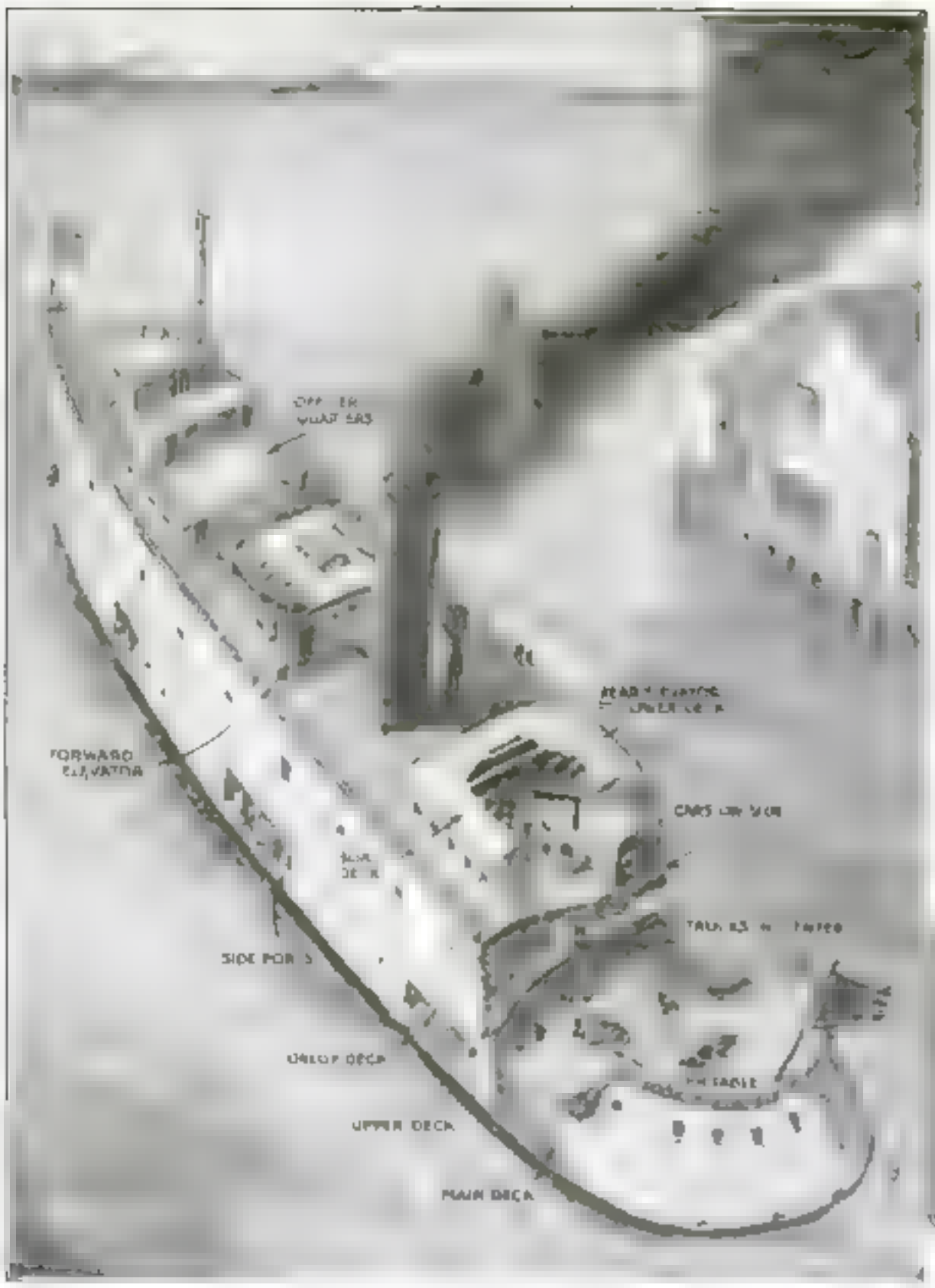
Feather-Weight Air Mail

HOW about sending mail across the ocean by airship? Your letter will reach the other side in ever so much less time than it takes for it to travel by ship, but won't the price be prohibitive? This is the most troublesome question that comes up when mail by air across the sea is discussed.

Major-General Sir Percy Cranwill Girouard has devised a plan that will make airship mail cost little more than ordinary mail service. He would photograph the contents of each letter and develop it on a film an inch by three quarters of an inch in size. The film would be sent across the ocean, and would be printed, when it arrived, on a sheet of eight-by-ten-inch letter paper. It would be placed in an envelope, addressed, and mailed.

The film weighs just one fiftieth as much as the ordinary letter, envelope, and stamp, and thus fifty film letters could be sent in the place of one regular letter

This original idea would solve the problem so far as business letters are concerned, but of course a scheme of this kind is not likely to be very popular in the case of personal letters, since they would have to be twice exposed to strange photographers and cameras.



The very latest thing in commercial steamships is a boat built to carry automobiles and motor-trucks for distribution along the Atlantic seaboard

An Automobile Ambulance for Injured Cars

POSSIBLY there is nothing in the way of garage equipment more necessary to the man doing a general automobile repair business than the automobile ambulance. There is no work, in connection with the repairing of automobiles, that is so irksome as that of getting a disabled car out of a ditch or off a telegraph-pole and transporting it several miles or blocks to the repair shop, unless the man handling the job is properly equipped for that work.

When attached to the front axle the ambulance is clamped securely to the center of the axle, thus supporting the entire front end of the car and allowing the tongue of the ambulance to control and guide the car. When attached to the rear axle it is ordinarily applied to the brake-drum on whichever side the injured wheel may be located. In extreme cases, however, where both rear wheels are out of commission, the ambulance can be applied to the center by lashing it to the middle of the differential housing or, preferably, to a bar lashed across under the rear system. It will pay for itself in its first job.

The automobile ambulance enables the garageman to save money by handling his "tow-in" jobs with only one man

This Ship Was Built to Carry Automobiles

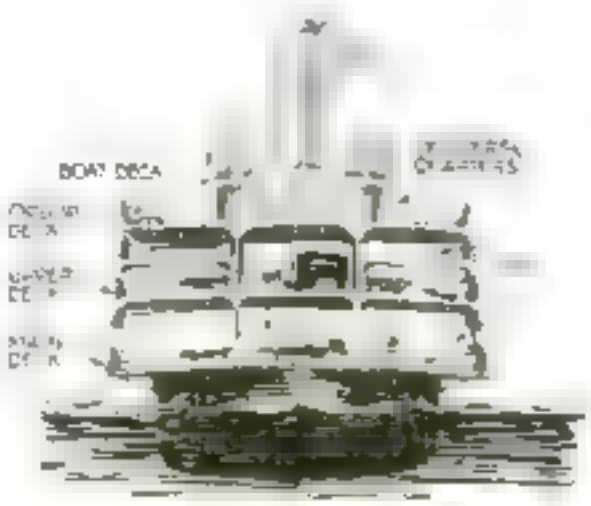
THOUSANDS of automobiles, and even motor-trucks, have been shipped by boat across the Great Lakes to Buffalo, and then driven overland to their destination in New York or New England. Most of such shipments were made under difficulties, because the vehicles were carried on regular passenger vessels. Now, however, a navigation company of Detroit has designed a boat especially for the service, so that the transporting can be done on a large scale. The vessel, designed by Mr. Frank E. Kirby, is shown in the accompanying broken-away illustrations.

The ship will carry only the officers and crew, and will be operated as the fluctuating production of the two automobile cities direct.

This automobile ship will be three hundred feet long and seventy-five feet beam, and will be capable of carrying between three hundred and seventy-five and four hundred motor-cars and trucks. Most of these will be carried under cover on the two principal decks, but some may be loaded on the upper deck on the outside.

The ship will have several new features never before included in an ordinary passenger-carrying steamer. These include extra large side hatches wide enough and high enough to load the biggest motor-truck with its body; elevators for transferring the vehicles from the main-deck to the upper decks; and turntables on the two principal decks to make the handling easier.

The two elevators are located on the center line of the ship directly in a line with each of the two large side hatches. The vehicles will be run on to the boat under their own power, and will not be moved by manual labor, except when necessary to place them in position on the ship.



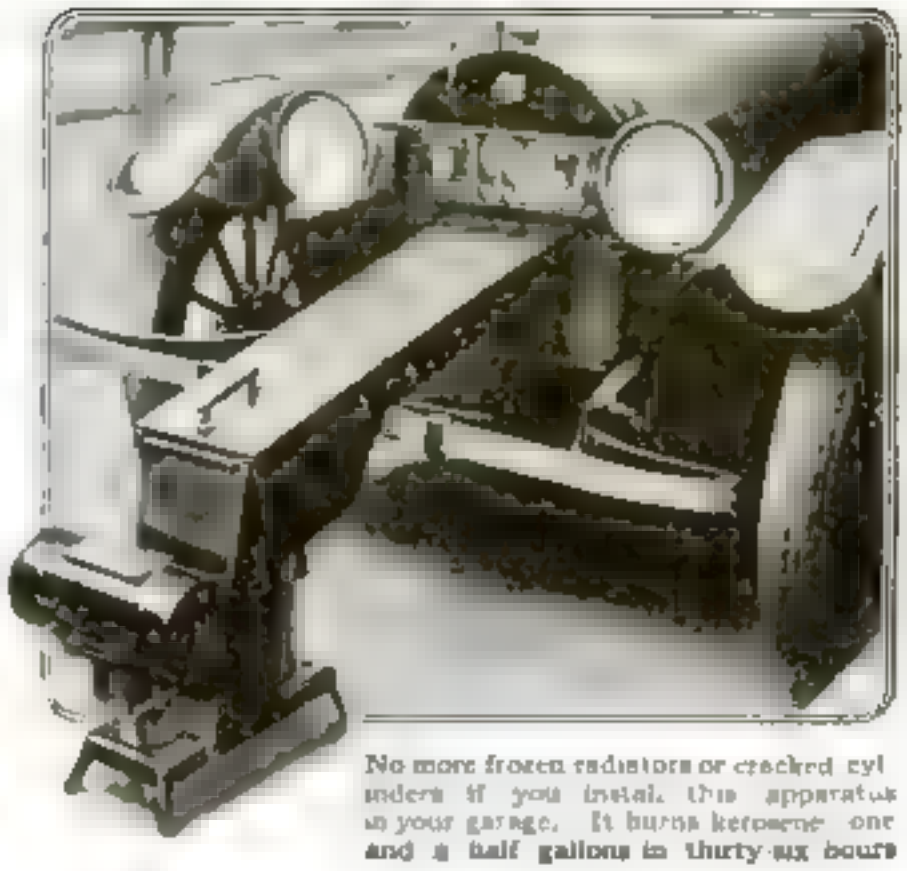
Two elevators located amidships permit even the largest motor-trucks to be taken aboard and stored away in the hold

Let Your Thumb Help to Identify Your Car

EVERY reader is familiar with the finger-print method of establishing the identity of criminals and ferreting out clues to obscure crimes. The newest use for this science, which dates back to the days of the ancient mandarins of China, who used their thumb-prints as royal seals over life and death, is to identify stolen cars and protect owners from such thefts. Also the prospective purchaser of a used machine can assure himself that the person offering the car for sale is the rightful owner by asking him to show an identification card bearing a duplicate of the thumb-print.

A label, with a white field for the print, is transferred on to the cowl or curved strip between the hood and windshield. This transferring is done with a waterproof solution which affixes the label permanently to the varnish. A roll impression of the complete pattern of the ridge formations of the thumb is then made on the white field of the label, with special ink, which burns through the varnish finish.

Here is a safe and sure way of determining whether a car is operated or owned by the rightful person



No more frozen radiators or cracked cylinders if you install this apparatus in your garage. It burns kerosene one and a half gallons in thirty-six hours

It Keeps Air from Freezing

FOR the car owner, the time lost in attempting to start a cold engine when the gasoline will not vaporize readily is exasperating; but for the motor-truck owner or driver, it is even more than that, since it prevents the truck leaving the garage on time for its day's work.

Troubles of this nature may be overcome by the combined car or truck and garage heater shown above. The apparatus consists simply of a kerosene burner with a special flue which is placed with its open end close up to the vehicle radiator. The fuel is burnt inside of the flue base and the heat passes through the radiator.

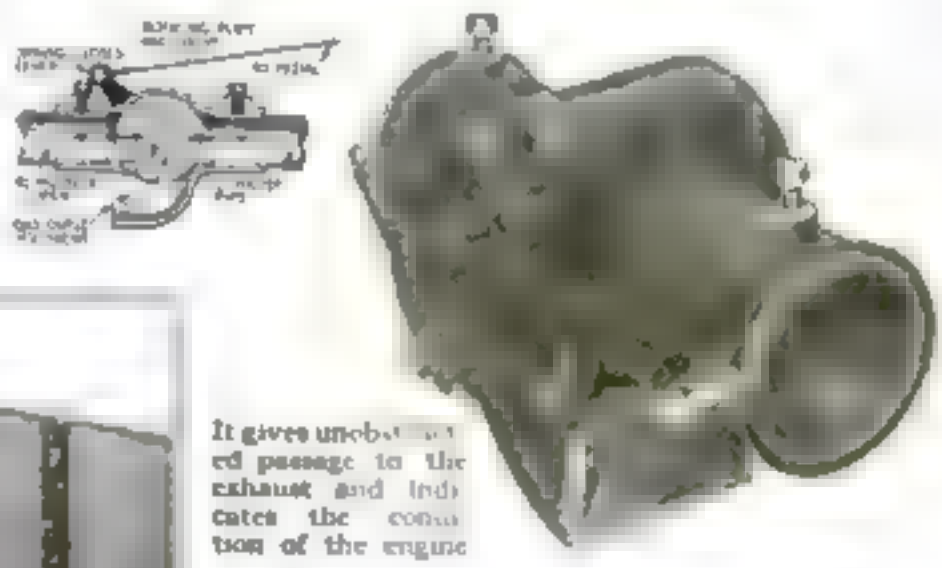
A Tractor Turns Locomotive

A PRODUCE dealer was occasionally in need of power at short notice for hauling freight-cars from the siding near his warehouse. It was his custom to order six horses from a livery stable, but this was expensive.

He asked a tractor sales man to help him out, but warned him that one tractor had tried and failed.

The salesman hitched his tractor to a loaded freight-car with a total weight of 58,340 pounds, which was moved easily. It then hauled a train of freight-cars, three empty and one loaded, the weight being increased to 170,000 pounds.

This tractor pulled four big freight-cars weighing 170,000 pounds, and didn't hesitate about it either. The train was pulled from a dead stop with all cars coupled



It gives unobstructed passage to the exhaust and indicates the condition of the engine

Use the Exhaust to Test the Engine

IT used to be common for motorists to open their muffler cut-outs instead of blowing their horns. While this is unlawful, cut-outs may be used in testing the engine.

One motor-testing valve designed for this purpose is shown above. It is made of cast iron and is placed somewhere in the exhaust line ahead of the muffler. The valve consists of a cylindrical barrel with a bell-mouthed outlet at the bottom. A segmental valve, operated by a pedal against the compression of two coil springs outside of the barrel, is moved to open the bell-mouthed outlet when the sound of the exhaust gases is to be heard.

Just an oblong piece of metal set in the road-bed, but it sounds a warning toot as the car passing over it approaches the curve just ahead

A Voice from the Roadway

"SOUND your horn!" "Dangerous curve ahead!" The roads are well fortified with these bright red warnings. But you can't see signs by the roadside at night, and you surely don't want to toot your horn continually, waking sleepers in the houses you pass. What then?

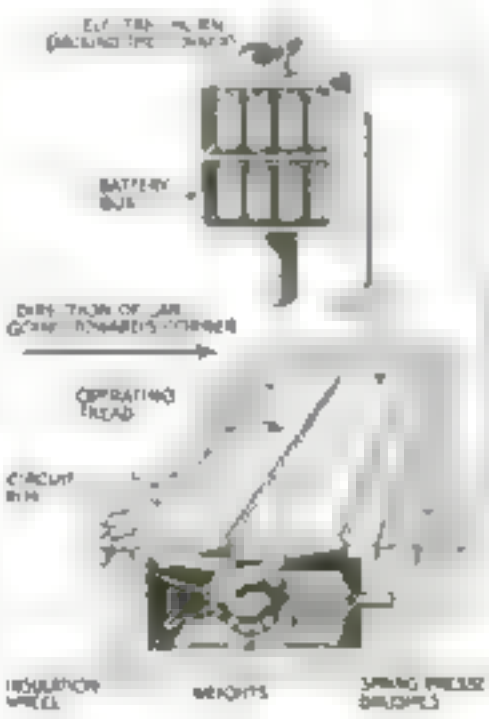
The solution lies in the unpretentious oblong piece of metal lying in the road in the picture above. As your car passes over it a horn a few feet in front of you automatically toots loud and long, letting the people around the curve know that you are coming

The device is not unlike the light signal system used in the New York subways and that are operated automatically by the trains

You will notice two treads running lengthwise. As your car passes over the one on the left it will be depressed and an arm extending downward from it will hit a ratchet wheel. This wheel then rotates and carries with it a larger wheel attached to its shaft

Contacts on the large wheel will hit against electric brushes as it rotates. Wires from the brushes lead to the horn and its motor When the circuit is thus closed the horn will toot.

But why have this revolving wheel instead of ordinary metal contacts? Because if your automobile is going at the usual rate of twenty miles an hour the tread will be depressed for only about one hundredth part of a second — much too short a time for even starting the motor in the horn. The revolving wheel tends to prolong the contact.



As the operating tread is depressed, a contact is made through a revolving wheel and a horn on a post a few yards ahead will toot

And now for the tread on the right side. This prevents the horn from tooting unnecessarily when a car approaches from the opposite direction where it has already passed the danger.

The right tread likewise has an arm attached to it. But this arm is fixed at an angle so that it almost touches the arm of the left tread. Then, when the right tread is depressed, the right arm swings into the left one and throws it clear of the ratchet wheel. There is no rotation and no consequent tooting.

The device was invented by Charles E. Lyman, of Asheville, N. C., and the first one was installed on "Dead Man's Curve" in Buncombe county near the building of a casket company!

A Betrousered Lady

"I CARE nothing for style; I can wear the suit I have on indefinitely," said Miss Fanny Harley just before she stepped into a taxicab. That, presumably, is why she wears trousers instead of skirts.

We will admit that she isn't stylish, but can she wear her costume indefinitely? It's made of white cloth trimmed with white fur, and even if she travels around in taxicabs her costume will get dirty within a very definite period

Miss Harley came from Arizona to New York to see the town and to gather material for magazine stories. She is convinced that women's success in the business world is threatened by their conventional, fashionable clothing. Undoubtedly, she would prefer to see our stenographers dressed in white trousers and white fur-trimmed jackets We gravely doubt that this would add to their efficiency.

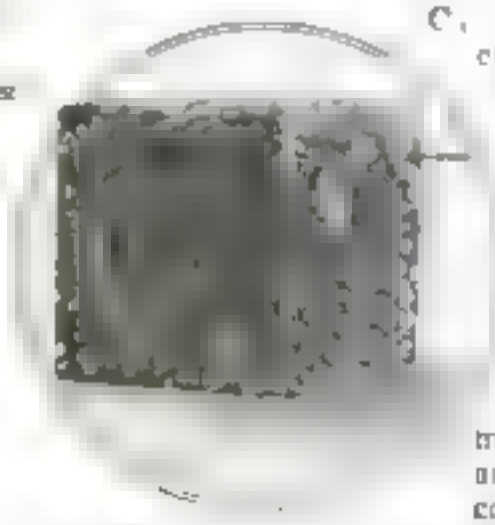
White trousers and a fur trimmed jacket are the simplest clothes, says the wearer we don't agree with her

Within the Law

THE bone-dry amendment forbids alcoholic drinks, but says nothing whatever about solids. Is this an oversight?

Whether that is the case or not, jellied alcoholics eaten with a spoon are perfectly legal. And so we have the solid cocktail shown in the picture below. The delectable chunk was concocted by Dr. John C. Olsen, a Brooklyn chemist, and was served at the annual dinner of the Alumni of the Polytechnic Institute, and the Alumni all joyously agreed that it was well worth eating.

But, alas, we must state that Dr Olsen has refused to make public his formula, and will not go into the cocktail business. His interest in it was purely scientific and not at all commercial, and our hopes for tasting one must die. Indeed, Dr Olsen is quite surprised and perturbed at everybody's interest in his cocktail.



This is a jellied cocktail legal because you don't drink it but alas! the chemist who concocted it will make no more

Probably every American soldier in France had a chance to observe the making of *eau de vie* (water of life), the national French drink. The French prize it to the degree that their highly descriptive title indicates, and make it at nearly every farm-house.

Eau de Vie

Eau de vie is a brandy, the raw material being the grape-skins left after the wine has been pressed from the grapes in the fall of the year. It is mostly an economical Frenchman's plan for getting still more good from his grapes. The old stems and other residue from wine-making are piled in cellars, and allowed slowly to ferment, until winter-time and the advent of the traveling still. This traveling still looks like a merry-go-round engine in this country, but it has two huge copper retorts back of its boiler wherein the grape-stems and skins are given a thorough steeping under steam-pressure. The vapors resulting at a late stage in the process are condensed, and this is the *eau de vie*.

Instead of calling the stuff "water of life," Americans in France termed it "white mule"—"white" because of its water-like clearness and "mule" because of its prodigious "kick." Few there were who could ride the white mule with success, or who cared much to try it after seeing its effects. But the old village fathers with their leather-lined interiors would gather around the stills, lips smacking and little tin cups clinking—one of the few times in the year when they thoroughly enjoyed themselves.

Eau de vie, poured out on a tile floor and ignited with a match, will burn like alcohol under a chafing-dish. It is no wonder that white mule throws the ordinary rider.

So much for the process of distilling from fruit. When the distiller uses grain as the raw material, the kernels of barley or rye, or whatever is used, are allowed to sprout, just as was the case in beer-making. Then this grain is mashed up with water, and the whole allowed to ferment while standing in a suitable warm place. The liquid may be separated from the solid in the fermented mass, and the two run through the still separately, or both may be boiled in the apparatus together.

Whiskey at Last

At any rate, the liquid coming from the worm is that which the operator desires—whiskey, in this case, instead of brandy, as was obtained when fruit served as the raw material. Russian *vodka* follows the same general process, the *pulque* of the Mexicans, the *sake* of the Japanese, and the native liquors of many other countries.

The art of distilling is very old. The modern gentleman with a thirst, who hits upon the idea of appeasing it by little operations with a still off in a dark corner somewhere, has developed no new idea. His great-great-great-great-great-grandfather knew all about the secret. And even grandfather's great-great-great-etc., was also well acquainted with the methods by which sundry spirituous liquids may be derived.

It is even recorded that the Chinese, many hundreds of years before the Christian era, made something they called *samchoo*, which they drank with great gusto. The natives of India, Egypt, and other Eastern countries were more than passing familiar with alcoholic liquors four thousand years ago, and used to get drunk now and again—mostly again—whenever the spirit moved them.

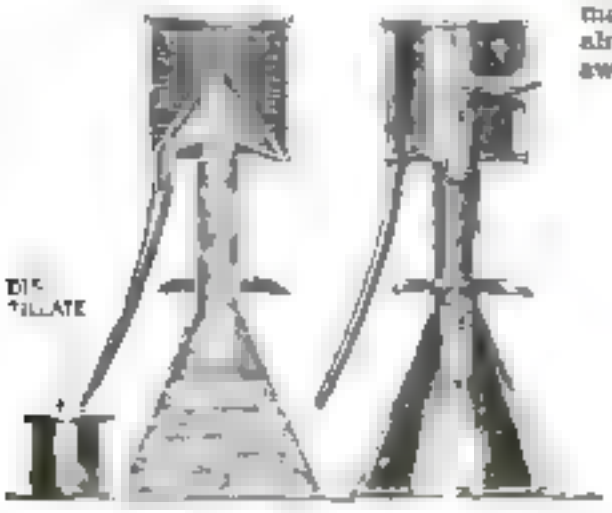
So the modern investigator has plenty of precedent, such as it is. The only difficulty is that these times "ain't" like those of old. The average bleary-eyed person will tell you with much sadness that they "ain't."

Naturally, the reason they aren't is the law. Sad to relate, the law steps in and says *no*. It is not at all bashful, either, in the way it says it.

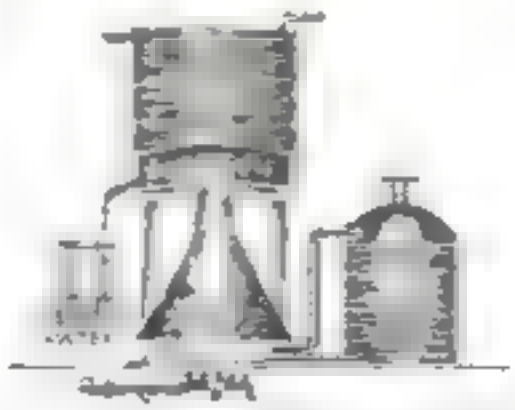
First, take this law—and it's from a whole bookful that the Bureau of Internal Revenue operates under:

> Where any marshal, or deputy marshal, of the United States, within the district for which he shall be appointed, shall find any person, or persons, in the act of operating an illicit distillery, it shall be lawful for such marshal or deputy marshal to arrest such person, or persons, and to take him or them forthwith before a judicial officer. This judicial officer may reside in the county of arrest, or, if there is none there, the one nearest this county may act.

"Oh, boy! Dat shuah am pow'ful stuff." 'Rastus has been reading in the paper what may be done with corn mash, tea-kettles, and such. One cupful, and 'Rastus already sees wildcats. Says he "I'se gwine arrive away from here! Wowie, Whoosh!" East 'Rastus



For "distilling water and other liquids," claimed William P Swartz, of Telluride, Colo., in 1891 Its ancestors, two funnels, a tomato-can



George W Crispell, of Albany, N Y., 1917, had the needs of garage storage batteries in mind, he says, when he invented this water still

Stovepipes, tea-kettles, and syrup pails were evidently all on Emma Jester's mind (Pueblo, Colo., 1902) when she thought this up

In such a court, the law goes on to say (in effect), the offending persons may be committed to jail to await trial, allowed to go out on bail, or otherwise dealt with, as the particular case may demand

That "Registered Distillery" Sign

Man's days are few and full of trouble when he starts to operate an illicit still that you easily gather. But how much of a still do you have to be the operator of before you qualify as a distiller? If a man ran just a "teeny little bit of a still," you say, he wouldn't come within the meaning of the law, would he? Ah, yes, but the drys have covered that. Read this:

> Every person who produces distilled spirits, or who brews or makes mash, wort or wash, fit for distillation or the production of spirits, or who, by any process of evaporation, separates alcoholic spirit from any fermented substance—or who, making or keeping mash, wort, or wash, has also in his possession a still, shall be regarded as a distiller

Would not this last section get you broadly and comprehensively if you tried experimenting with stills at all? It would.

Then, as if this foregoing were not enough, consider the following.

> Every person engaged in distilling or rectifying spirits, and every wholesale liquor-dealer, shall place, and keep conspicuously on the outside of the place of such business, a sign, exhibiting in plain and legible letters, not less than three inches high, painted in oil colors or gilded, and of proper and proportionate width, the name or firm of the distiller, rectifier, or wholesale liquor-dealer, with the words,
>
> REGISTERED DISTILLERY
> RECTIFIER OF SPIRITS
> WHOLESALE LIQUOR DEALER
>
> as the case may be.
>
> Every person who violates the foregoing provision by negligence or refusal, or otherwise, shall pay a penalty *of five hundred dollars.*

You hadn't thought of this little matter of placing a "Registered Distillery" sign on your house in case you operated a still, had you? And in case you should put up such a sign without duly registering and paying the proper fees and taxes, listen to what happens to you:

> Every person who illegally puts up, or keeps up, the sign required in the foregoing section or any sign whatever—indicating that he may lawfully carry on the business of distiller, rectifier, or wholesale liquor-dealer, shall forfeit and pay the sum of *one thousand dollars, and shall be imprisoned not less than one month nor more than six months.*

Trouble awaits you if you merely go over and have a look-in on the still friend Jones is operating. Listen:

> Every person who produces distilled spirits, or who brews or makes mash, wort or wash, fit for distillation or the production of spirits, or who, by any process of evaporation, separates alcoholic spirit from any fermented substance—or who, making or keeping mash, wort, or wash, has also in his possession a still, shall be regarded as a distiller

Every person who works in any distillery, rectifying establishment, or wholesale liquor store, on which no sign is placed or kept as hereinbefore provided—and every person who knowingly receives at, carries, or conveys any distilled spirits to or from any such distillery, rectifying establishment, or store—or who knowingly carries and delivers any grain, molasses, or other raw material to any distillery on which such a sign is not placed and kept, shall *forfeit all horses, carts, drays,* wagons, or other vehicles or animals, used in carrying or conveying such property aforesaid, and shall be fined not less than *five hundred dollars* nor more than *five thousand dollars,* or be *imprisoned not less than six months nor more than three years*

What's the Moral?

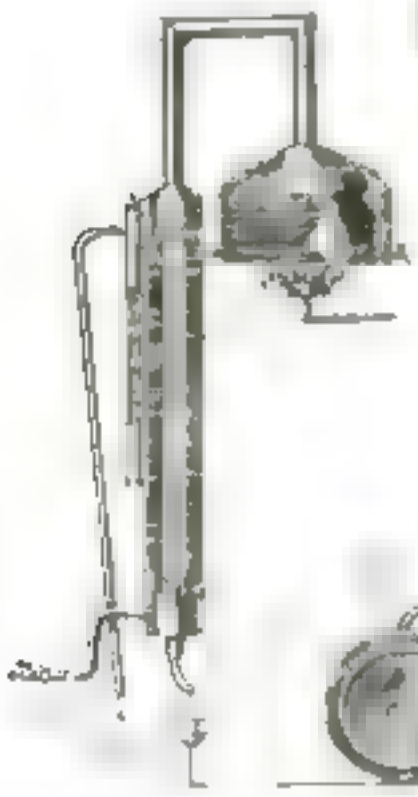
Wowie! The moral is, don't be caught around anybody's illicit distillery. If you haven't any horses, carts, drays, wagons, or wheelbarrows that you happen to be using for the furthering of the business, they are likely to take your flivver if it happens to be standing around, or anything else that looks full of possibilities. Who knows? And on top of that a fine and a possible sojourn in the local "hoosgow."

Now that the national prohibition law is in imminent effect, there is no possibility of paying whatever dues are necessary, and getting permission to operate the still, having put up the sign; so, whichever way you look at it, it seems as if they have you coming and going

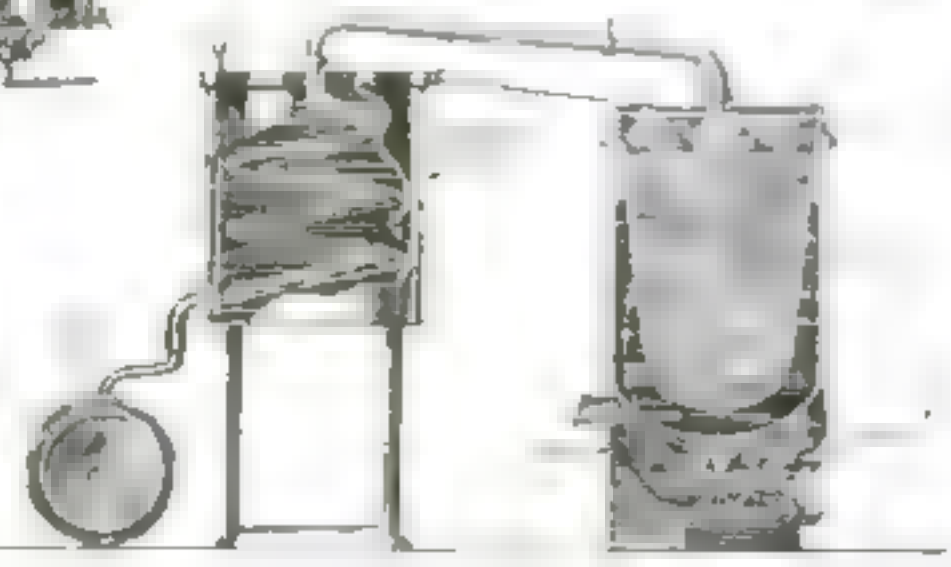
It is even unlawful to have the pieces of a still in your possession. The net effect of all the new prohibition laws is simply to add to, and make more restrictive than ever, the legislation and rules and regulations that already existed.

At present you may not have even a water still of any size at all, for the production of, say, distilled water for your automobile batteries, unless you register it and the authorities are satisfied that it's distilled water you're going to make. And our revered Uncle Samuel is most suspicious about said stills at the immediate moment.

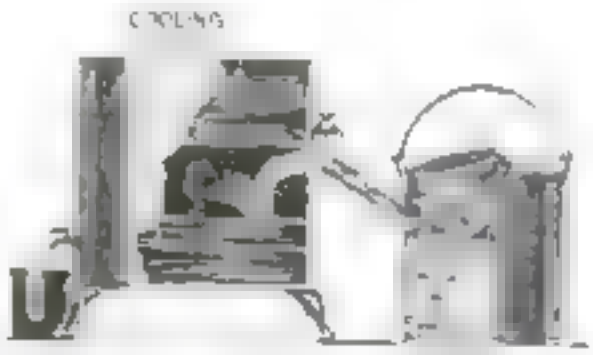
J. J. Gilchrist, of Pittsburgh, Pa., thought up this nifty idea in 1910. He would get alcohol out of old barrels by warming up their wet interior with an electric heater then cooling down the vapors produced in an appropriate worm until the real thing resu[lted]. H[ere's a] little railroad bridge, don't you weep you'll be a dis[tiller] while we sleep"



Russell H. McMillen considered this a good idea in 1912



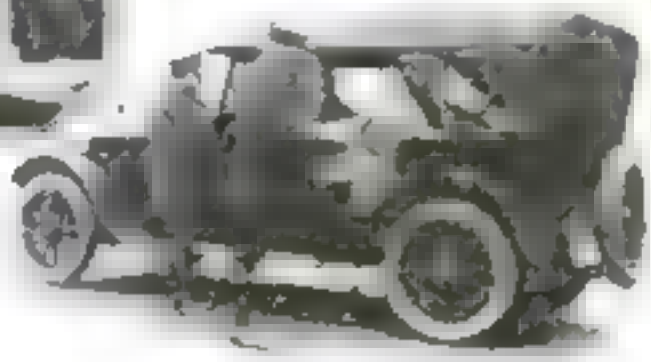
George Laczay, who was born in Hungary, a resident of New York, did this one in 1910. It is built for quick action and great quantities at a time. Would Hungarian goulash do for the mash?

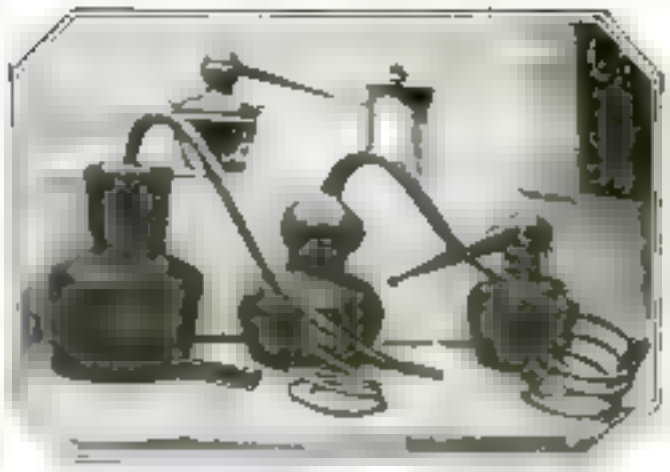


Simple apparatus suffices in Arizona. Messrs. Warren and Healy of Fort Thomas, 1902, asserted that this was used for water only

The gentleman tests out a mountain still in the government's Washington laboratory "Aha," says he," 'tis the real stuff

Scenes like this have been common the last six months. This one occurs along the road between Washington and Baltimore. Bootlegging has been common, had been getting away with it. The gentlemen are—in a manner of speaking—"perched"





A collection of local talent stills Internal Revenue agents have gathered from one place and another over the country

Now, what is it that puts the teeth in all of the foregoing laws? Who are the gobuns who'll get you if you don't watch out?

There are enough of them. Besides all the United States marshals mentioned in the foregoing, and all the city, county, and state officials you can think of yourselves who might have hand in it, there are also the doughty inspectors of the Department of Internal Revenue in Washington. These gentlemen are equipped with noses that can detect the odor of C_2H_5OH from afar.

More than that, they are thoroughly on to the ways of amateur alcohol producers. He has to be a good man indeed who can get by them for long.

The Chemical Goblins

Back of them, and to make the evidence they obtain an exact and known quantity instead of a murky and dubious fluid of uncertain antecedents, as it usually is when found, there is a large chemical laboratory in operation on the top floor of the Treasury Building in Washington.

The experts who are employed in this chemical laboratory can analyze almost anything. Whether a concoction has alcohol in it, in the first place; if so, how much; whether there are any other narcotics in it besides alcohol; what they are, and in what degree these are some of the points they can determine about a liquid under suspicion.

Glass retorts and stills of one kind and another fill long racks down the center of the laboratory rooms. Reagent bottles stock the shelves, there is a steaming, foaming test of mysterious character going on at each of the tables.

Men and women investigators, long-aproned and with a detached, absorbed look on their faces, watch the steaming retorts—frequently pausing to withdraw some of the liquid and shake it up in test-tubes with reagents.

Surprising the Moonshiner

Then takes place a characteristic change in color, a precipitate is formed, or other activity occurs that the keen eye of the chemist can detect, and the inmost secrets of the liquid are revealed.

Other tests, besides those with reagents, are made. And so it is that sooner or later all the unknowns in the suspected liquid give themselves away.

Many a moonshiner has had his product subjected to more kinds of analysis and scrutiny than he ever dreamed men knew anything at all about before. Frequently he has gone behind stone walls for a long term because of the ability the testers have developed in ferreting out things that he had supposed were carefully camouflaged and hidden.

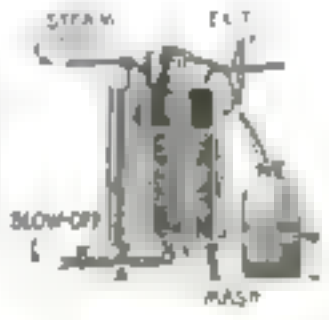
Many a patent medicine has come to grief at the hands of the Internal Revenue Bureau, many a hair tonic, a vanilla or lemon extract, many an opium product, and all other dubious concoctions the minds of men can think up to get around the law, and the public opinion that has made the law.

What then, weta, has become of your dream of operating a still in the house somewhere, and so getting around the constitutional amendments and other things the drys have recently put over on you?

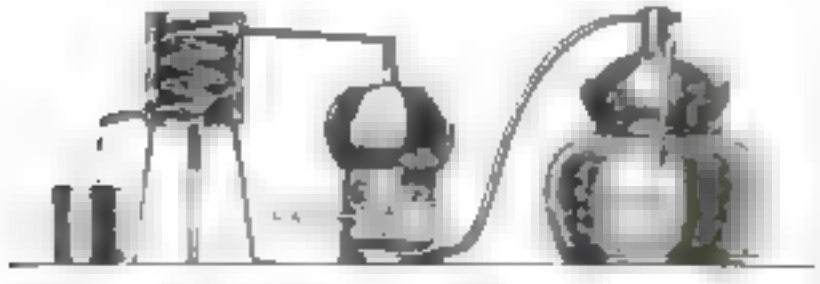
Gone it is, weta, gone for good. Touch not, handle not, have nothing to do with stills—not in these days. If you do, there's likely to be everything from the local W. C. T. U. to one thousand six hundred and seventy-four United States marshals and Internal Revenue agents, camping on your trail.

Not a Chance

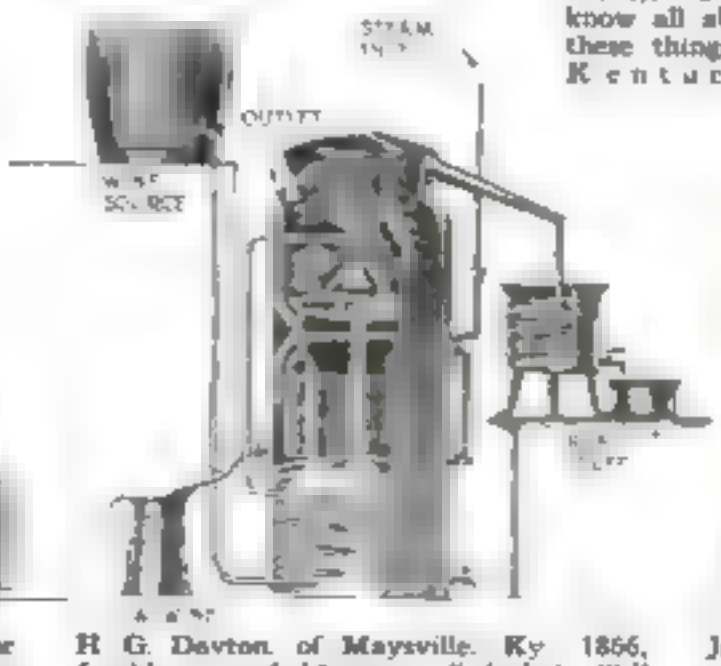
So, with the orchestra playing soft, soft music, turn back through these pages, look for the last time at all the pretty stills, and—forget stills; forget them for good. It's all they'll let you do.



Another of H G. Dayton's ideas (1861). They know all about these things in Kentucky



"Boiler-mash-it" is James Campbell's simple recipe for allaying the thirst of dry times. He had this happy thought in Rockingham, Va., as long ago as 1870

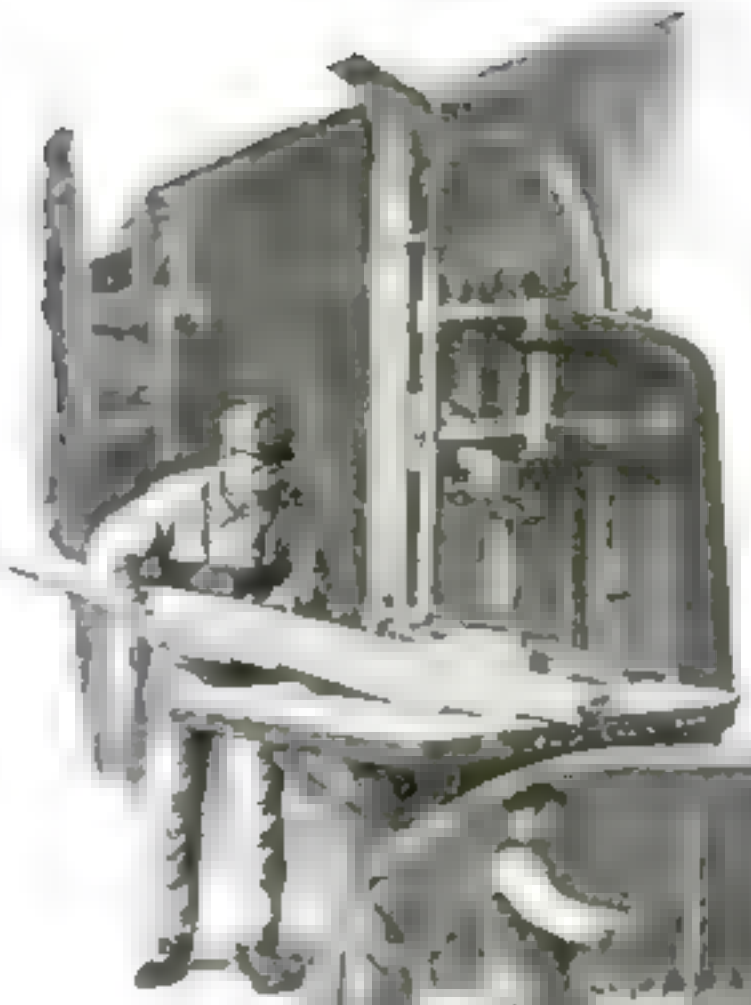


H G. Dayton of Maysville, Ky 1866, frankly avowed this was an "alcohol still." It converts poor stuff into real stuff

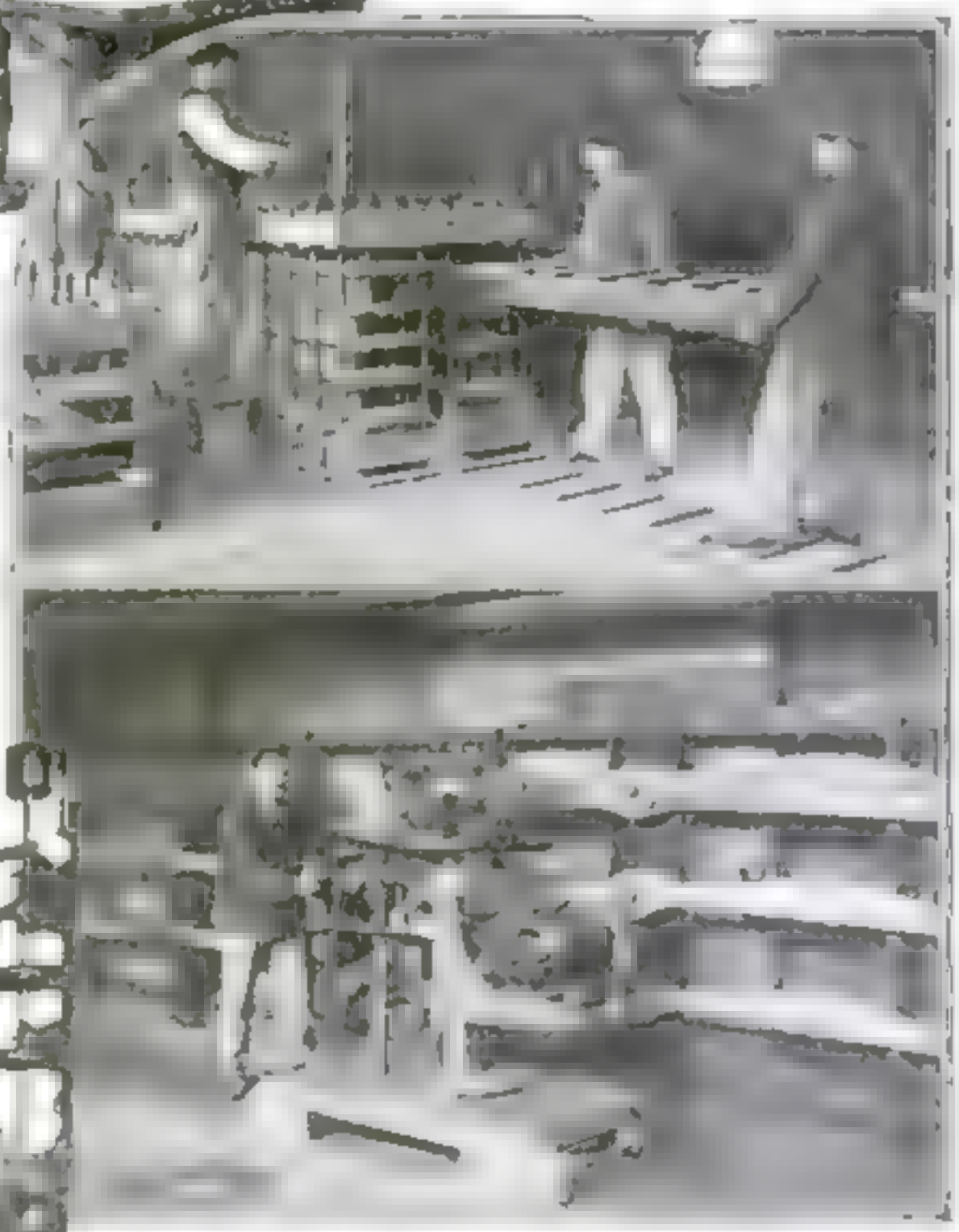
James T Van Ausdal, of Independence, Kan., made distilled water with this (1903

Men's Lives Depend Those Who Make the

The brains of the scientist, and the ingenuity of the in producing the propeller

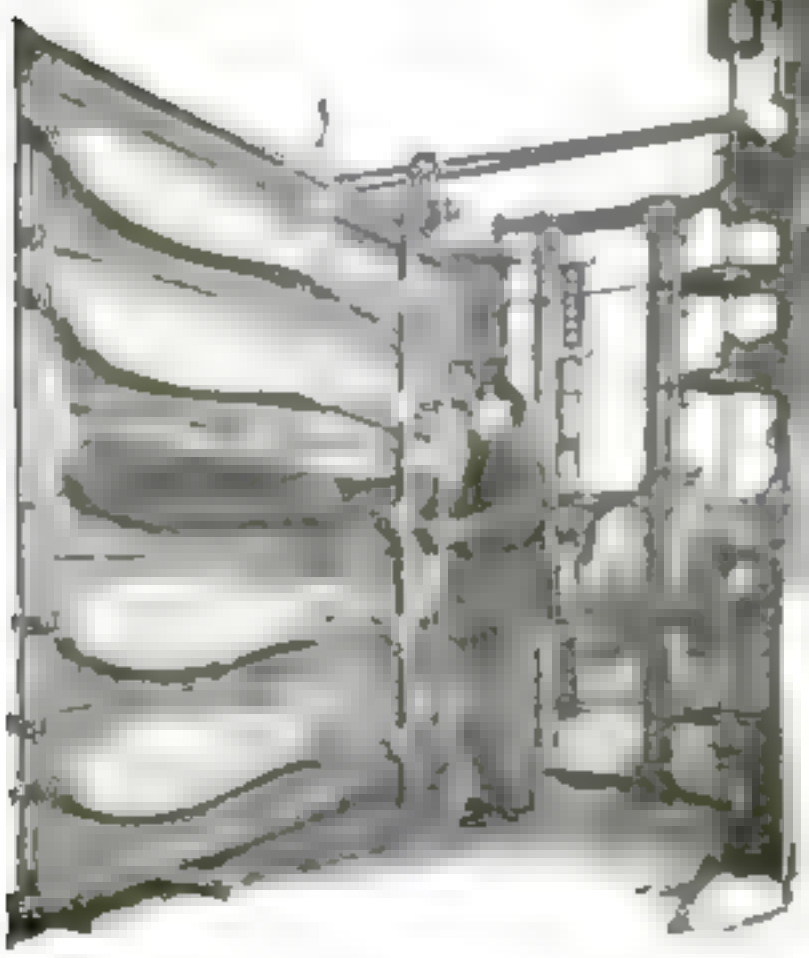


An airplane propeller is built up of layers of carefully selected wood arranged fanwise and glued together. From five to eight slabs of wood are thus glued together. The density of the wood, the species of tree from which it was cut, and its moisture content must all be taken into consideration by the propeller-maker



After the layers of wood have been glued together they are placed in a "glue press." The glue is applied hot. The propeller or rather the layers of glued wood out of which it is to be fashioned, is held in the glue-press for a period of twenty-four hours

After the glued layers of wood come from the press they are "roughed out." The corners are usually removed by a bandsaw. Then comes the shaping of the blades. This is still a hand operation in many factories, but during the war machines were introduced, like the one that is shown in the lower picture on the right, to speed up the work



Nearly every propeller factory has a machine like this—a form of pantograph. Such machines have long been used to make duplicates of statues. In the center of the machine here shown is the propeller to be copied. A tracing tool guided by the operator travels over the surface of the propeller. Cutting tools remove from the reproductions excess wood to just the depth indicated by the tracer on the master propeller. The tracer feels, as it were, the surface of the master propeller and communicates the results of its feeling to the other tools

Upon the Skill of Airplane Propeller

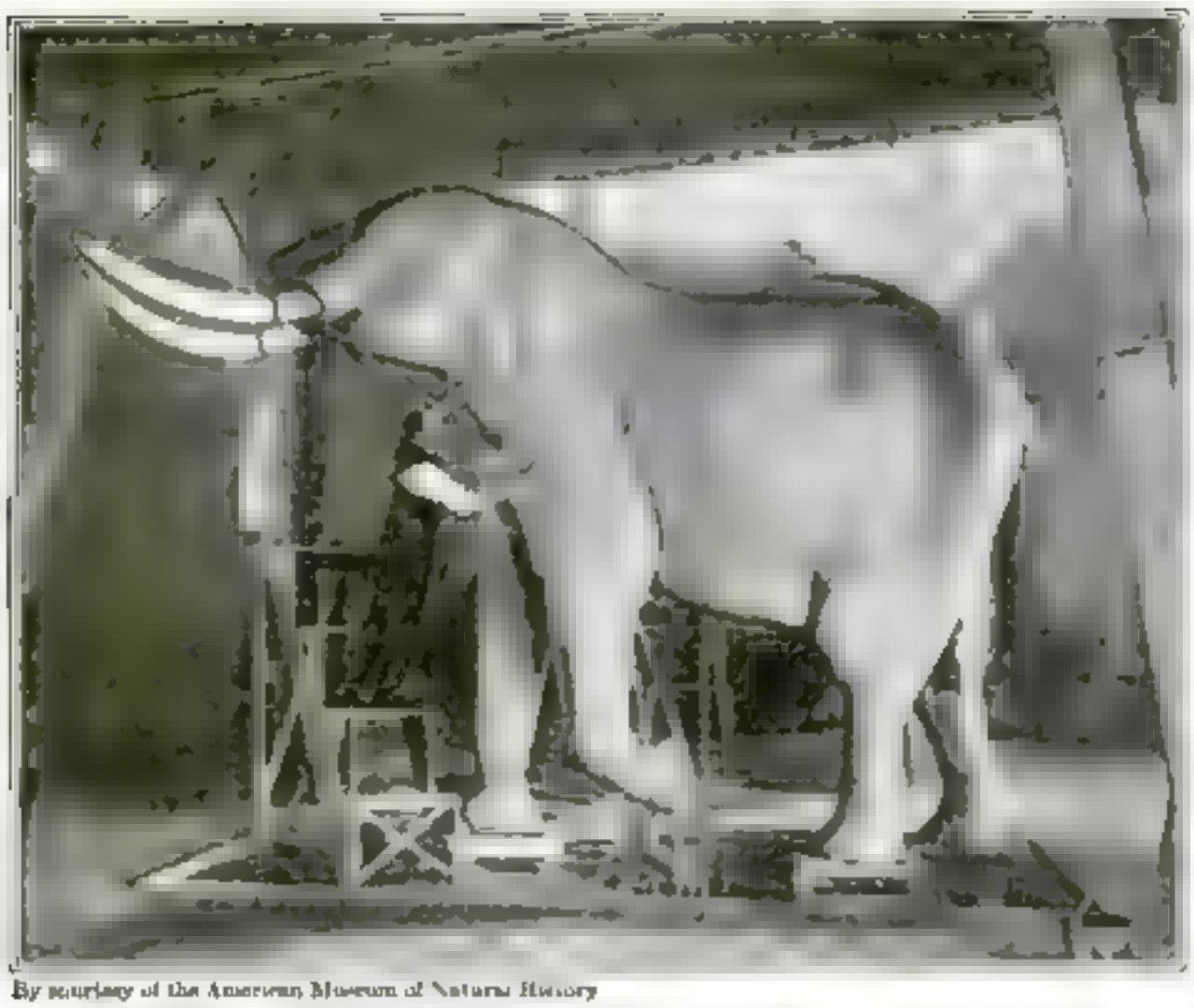
the art of the wood-carver, mechanic—all are combined that drives the airplane

A propeller's efficiency depends partly on its shape—a shape that has been carefully determined by mathematical calculation and by experiments in a wind-tunnel. The man in this picture is minutely measuring the surface of a propeller in order to ascertain whether it is accurately shaped or not. An astronomical lens is about the only other object we know of that depends so markedly on shape for its efficiency

A propeller must be so smooth that a fly would almost slip and break its neck if it crawled over the surface. It was Sir Hiram Maxim (from Maine, if you please) who first realized that an air propeller must be as smooth as glass in order to reduce skin friction. No piano has a finer gloss than that which is given to an air propeller by the most expensive spar varnishes and by very careful hand polishing

And now comes the most delicate operation of all—balancing the propeller. A propeller whirls around at the rate of about fourteen hundred revolutions a minute in the air. If it is unbalanced the strains to which it is subjected will tear it apart. The finished propeller is mounted on an axle that turns in nearly frictionless bearings. The blades must balance in any horizontal and vertical position, which means that the center of gravity must be in the exact center. If the propeller is not balanced in all positions a little wood is rubbed off here and there. Sometimes the touch of a varnish brush is enough to correct the faintest perceptible error

This picture summarizes the making of an air propeller. At the bottom, 1 shows the five layers with which the propeller maker starts. 2 shows the five layers glued together as they come from the glue press. In 3 the excess glue has been scraped off. In 4 roughing out has been started, as indicated by the appearance of the hub. In 5 roughing out is finished. 6 shows the propeller after carving. The process here shown is that developed by the Forest Products Laboratory



By courtesy of the American Museum of Natural History

Getting an elephant ready to have his skin tried on. His body is first modeled in clay with scientific accuracy

He Stuck to One Idea

CARL E. Akeley took up taxidermy as a career when he was a small boy in Rochester, N. Y. His first position was with Ward's Natural Science Establishment at the princely salary of $3.50 a week. Today he is known as the man who lifted taxidermy out of the upholstery trade and developed it into an art. He was the first to approach it from the standpoint of a sculptor.

Every one of his animals is first modeled in clay, with the muscles, tendons, and bones carefully reproduced, so that the skin, as in the case of the living animal, is drawn down over a beautifully modeled body.

A Truck that Lifts Barrels

A REAL labor- and money-saving device for moving barrels in warehouses or at freight stations is a high-wheeled hand truck which picks up the barrel and sets it down again, with very little help from the workman.

In operation, the apparatus is set up vertically alongside of the barrel to be moved, as shown in the illustration. A bail pivoted near the handles of the truck is then slipped over the top of the barrel to hold it steady. The barrel is released at the end of its journey by standing the truck vertically and swinging back the bail. The latter is provided with slotted end members working over bolts in the wooden side members of the truck, so that the bail may be adjusted to fit any barrel.

By the use of the apparatus, one man can truck more quickly and easily than two men with the old-style truck. Besides, with the new type of truck the load is on the truck and not on the man. The machine has still another advantage in that it eliminates the necessity for rolling heavy barrels, with the consequent rapid wear of the floor.

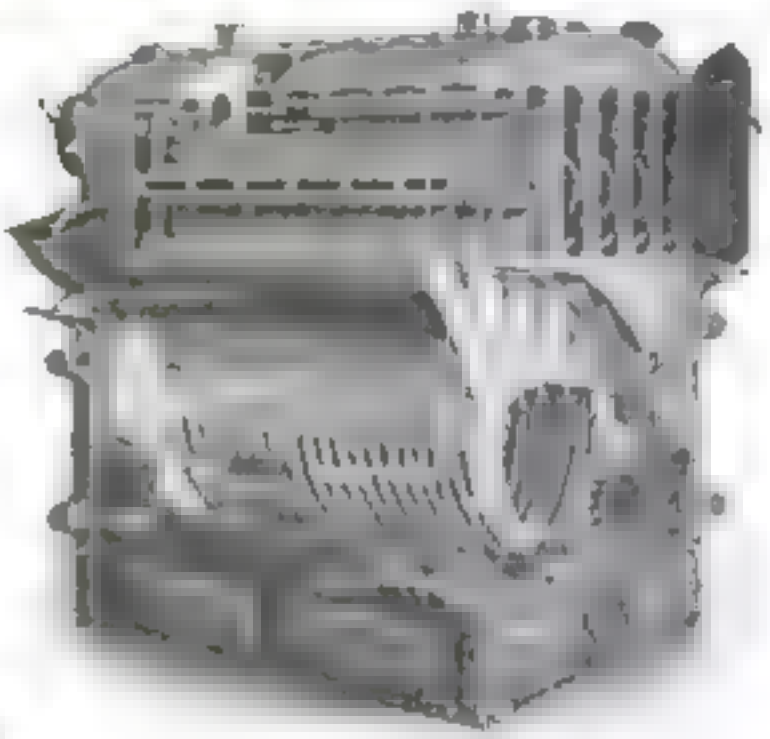
With this truck the workman can pick up a barrel without bending his back

Greater Efficiency from the Heating Boiler

A NEW heating boiler which presents many interesting and unusual features is of the sectional type and made entirely of cast-iron. The picture below shows the compactness of its design. It is provided with water grates which offer a large heating surface.

Air for combustion is taken in at the top of the furnace, passes downward through the fire and the water grate, and becomes thoroughly mixed with the gases generated by the fuel in the right proportion for bringing about the most nearly complete combustion. The manufacturers claim that the supply of air can be so regulated as to make the fire practically smokeless.

Either hard or soft coal may be burned in the heater. The feed can be regulated to suit the requirements of the fire. The magazines are large enough to hold fuel for from twelve to twenty hours.



This self-feeding water-heater is unusually compact and embodies in the arrangement of its furnace many features that increase efficiency

How to Keep Cider

PERHAPS the coming of the great thirst inspired the United States Department of Agriculture to take up the matter of cider in a serious way. It has found a way to keep cider sweet indefinitely

First, the fresh apple juice must be frozen; then the mass is crushed and whirled about rapidly to separate the frozen water from the mother liquor containing the solid matter of the apple juice. Five gallons of cider yield one gallon of a sirup-like concentrate. When you want to drink, all you have to do is to add water.

Why Laundering Kills Clothes

A bit of science applied each Monday will add weeks to the life of your linen

By I. Newton Kugelmass, Professor of Chemistry, Howard College

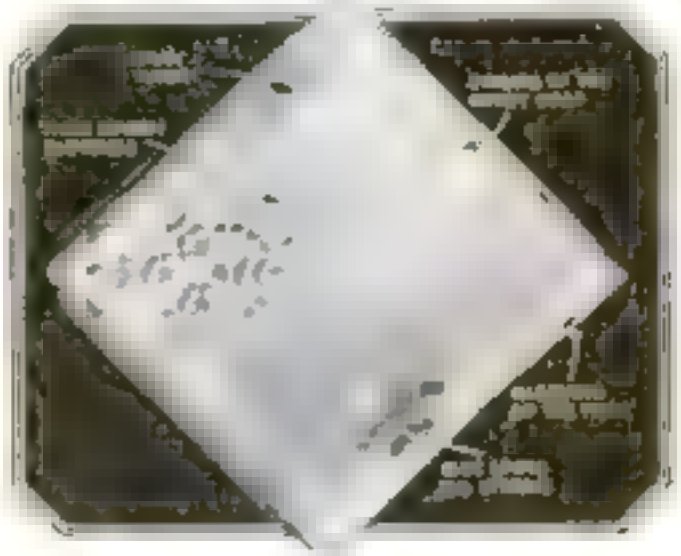
DIRT is matter in the wrong place. The business of the laundress is to remove it. The business of the chemist is to tell her how to do it. The life of clothes may be prolonged twenty-five per cent by scientific laundering.

The laundering process is started with soaking to loosen the dirt and save rubbing and thereby the goods, time, and energy. The great mistake made is to begin soaking with hot water. This coagulates the albuminous matter and starch, making them stick on the clothing with resultant blotches. Start with a cold-water bath, for cold water dissolves the starch and albuminous matter and gets rid of them for good.

The kind of water used should not be a matter of indifference. Woolens galore have been ruined by washing them in naturally hard water. The sticky soap settles in the pores of the wool fiber and materially reduces its wearing qualities. For safety and efficiency prepare the water before using it for washing. Add a minimum of ammonia, borax, soda-ash, or washing soda, enough to precipitate the objectionable minerals. Stir, let the water settle, and then allow the clear water to flow into the washing-tub.

With the water prepared, the next step is the actual washing operation, which involves combined mechanical agitation and cleansing action of soap. To get maximum service from soap we must know how it works. Soap first dissolved in the water reacts chemically, giving a mild alkaline medium. This medium prepares the way. The rest of the soap is very finely divided into microscopic particles, all evenly distributed throughout the whole solution—all the water is soapy. Each soap particle is a worker—a dirt capturer! The more finely divided the particles and the greater the number, the more efficient the cleaning. The best condition is attained by slightly increasing the alkalinity with a mild alkali—soda. These dirt-fighters work best in a moderately alkaline field. Since dirt is held in soiled goods by grease, soap cleans in two operations. It first removes the grease from the materials by forming an emulsion with it. The dirt without any grease support on the clothes is now pulled in (absorbed) by the fighting soap particles. Every soap particle carries a dirt-load on its back and keeps the grease in emulsion form.

Her soapsuds are cloth eaters, her bluing overused, the starch is full of germs, and your clothes are piled together with many other dirty clothes. Do you wonder that they don't last long?



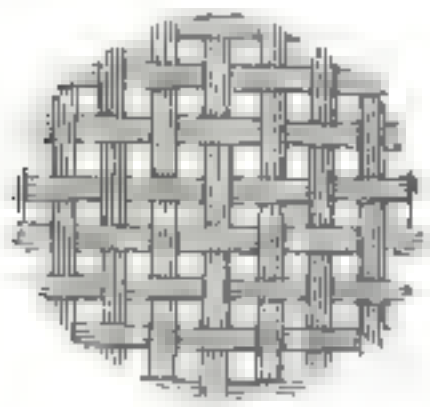
Hard water is very bad for the clothes; ammonia or washing soda should always be added—your handkerchief is likely to suffer from all the ailments shown above if you don't soften hard water

Many a laundress adds caustic soda to the soap solution. This gives an excessive alkalinity and ruins the strength, color, appearance, and wear of the clothing. Then, too, she does not invariably choose the best cleaning soap. It is "neutral soap," without free caustic, without fillers of water-glass, rosin, or peroxides, adulterations that loosen, weaken, and color the texture of the fiber. Neutral soap and a mild alkali together give the most efficient washing medium. The deadly policy of leaving the clothes overnight in the dirty soap bath "rots" them.

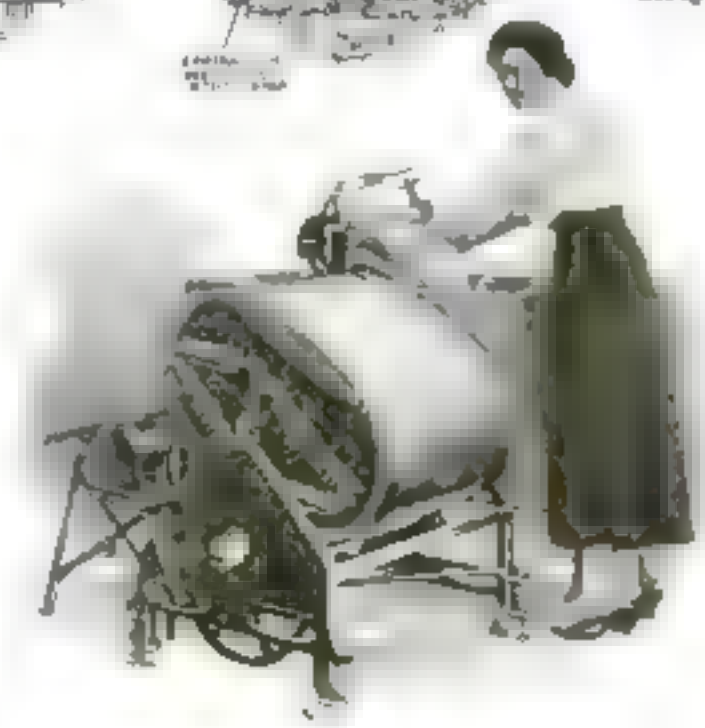
Using raw bleaching powder means more harmful effects on the clothes than hard water and caustic soda combined. Treat the bleaching powder with soda in a separate vessel. The sodium replaces the calcium, giving sodium hypochlorite, the bleach liquor, and precipitated chalk settles to the bottom and is rejected. The sodium hypochlorite is acted upon by the water, giving oxygen, caustic soda, and energy.

To bleach with little injury, use the least soda in making up the bleach liquor, so as not to have large alkalinity, keep the materials in the bleach a minimum length of time, heat the bleach bath gradually to prevent too rapid giving off of the oxygen, and rinse thoroughly, else the bleach liquor will "rot" the fabrics.

Rinsing should be thorough after each operation. Insufficient rinsing after the first suds decreases the soap efficiency in the second suds; after the bleach, ruins the clothes; before bluing, leaves the alkalinity to cause uneven setting of the blue; and also leaves the alkalinity to convert the starch into yellow decomposition products during ironing.



A typical case of before and after washing in hard water, the fibers are clogged with decomposed soap, which is insoluble



Even this most modern method of fighting dirt is not proof against the common mistakes of carelessly prepared water and of insufficient rinsing

One Way of Hiding the Evidence

DOES an automobile ever have five wheels? This is not a joke but a sensible question, which is answered in the picture below. The car shown there certainly has five wheels, one at each corner and one in a most unexpected part of the car—under the hood.

It needs that fifth wheel because it has no engine of its own geared to the rear axle, and must therefore rely on a separate motor wheel for its motion.

You surely have seen bicycles propelled by these motor wheels, and perhaps you have seen small cars pushed along by a motor wheel behind. But the idea of concealing the wheel under the hood is an entirely new and rather clever one.

In fact, the hood hides most of the evidence that the car is not self-sufficient.

Now Here Is a Real American Team

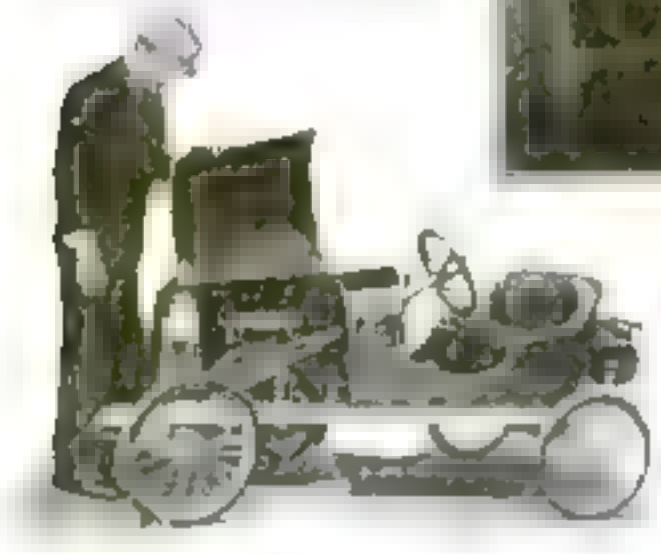
TO most of us the buffalo is a wild and woolly animal caged up in the zoo and coming originally from the wild and woolly West. A tame and gentle buffalo is a thing quite outside of our experience.

And yet, they have been tamed, have even been used instead of horses to draw wagons in some parts of the West.

In the picture below you see a buffalo team hitched up to a buggy, ready to take their master out for his morning ride. It is his custom to drive the team daily to the village to get the mail and do the marketing.

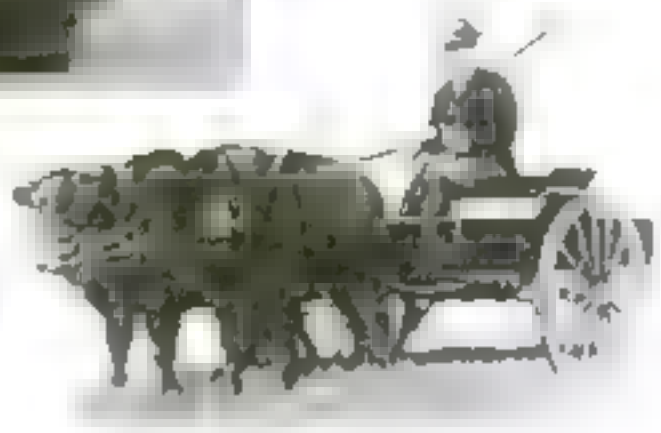
The villagers are used to seeing the buffaloes trot up—yes, they do trot, after a fashion—and stand outside a shop.

In days gone by buffalo teams were commonly used, but today, since buffaloes are very scarce, a team of them is very seldom seen.



A Ship-Shape Dining-Room

A SHIP on the rocks usually means tragedy, but not so the ship shown here. It was built on the rock by a restaurateur, and its deck is a dining-room. To board it you cross a regular gang-plank. If you would like to dine at sea but are afraid of seasickness, you will find this ship always calm, regardless of what the sea below is doing. That sea, by the way, is the Mediterranean, and the ship is located at Nice.



An Agile Man of Straw

THE old rag doll has a rival, the new straw doll. Its arms and legs are made of straw braids and its body is a continuation of its legs, with the braids left open. Just above the place where the arms join the body, a cord is wound around and tied. That is his neck.

Eyes, nose, and mouth are painted in their proper places, and a hat sits on top of all. You can twist his arms and legs about in various positions to suit yourself.

This straw doll plays while he dances: he holds in his hands a small accordion made of paper.

Given a few wisps of straw and some paper, anybody who is clever with his fingers could make a whole group of character dolls. In fact, the idea looks encouraging as an entertainment for convalescents from measles and other youthful illnesses.

Blindfolded Musicians

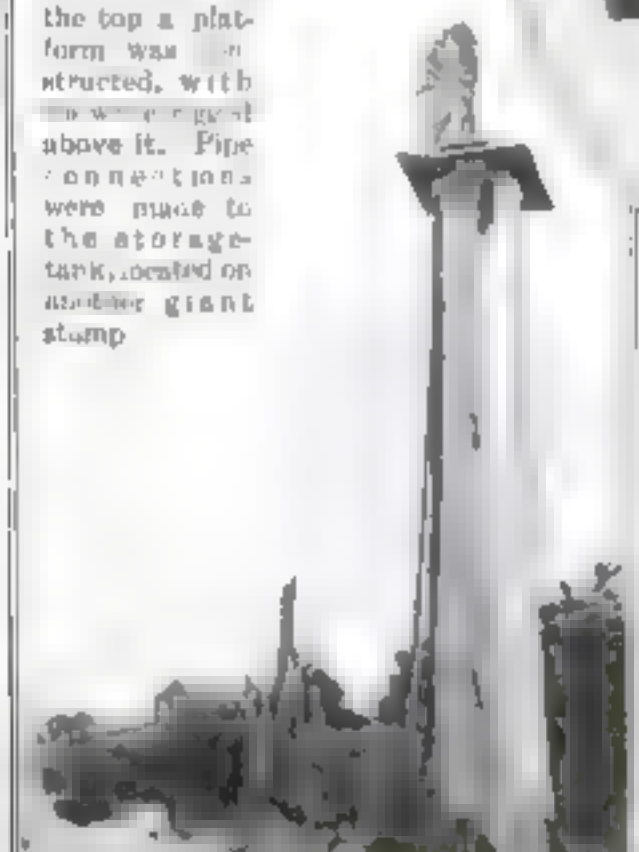
WHY does this Japanese street player hide his head while he plays? Is it due to excessive bashfulness? The basket must be most uncomfortable. It cuts off the air supply almost entirely, and yet it is a wind instrument this artist is playing!

The name of this musical instrument, which is very ancient, is shakupachi. It is somewhat like a flute, but it is much more difficult to coax a tune from it. In fact, the exact technique is kept secret between teacher and pupils, having been handed down from an old hermit who discovered the art. Perhaps that is why the players cover their heads. They don't want the passer-by to solve the mystery of their music.

The blindfolded musician is reminiscent of the English mummers, who in the holiday season disguised themselves and went from house to house to entertain their friends.

A Windmill on Top of a Tree-Stump

A WESTERN rancher was cutting down the giant fir trees on his land, one alone was left. As soon as he finished the job he intended to build a windmill. And then the idea occurred to him that he might use this last tree as a base for his windmill. He chopped it off fifty feet from the ground, stripped the tall stump of its branches, and shaved off the bark. A ladder was raised along the side and the top a platform was constructed, with a water-tank above it. Pipe connections were made to the storage-tank, located on another giant stump



Caught as He Jumped

WHEN directly above the spot where the Queen Dowager Alexandra of England was standing, Professor Newell jumped out of an airplane.

No, he didn't land on her head, he wore a parachute and carried [illegible] several feet away from her.

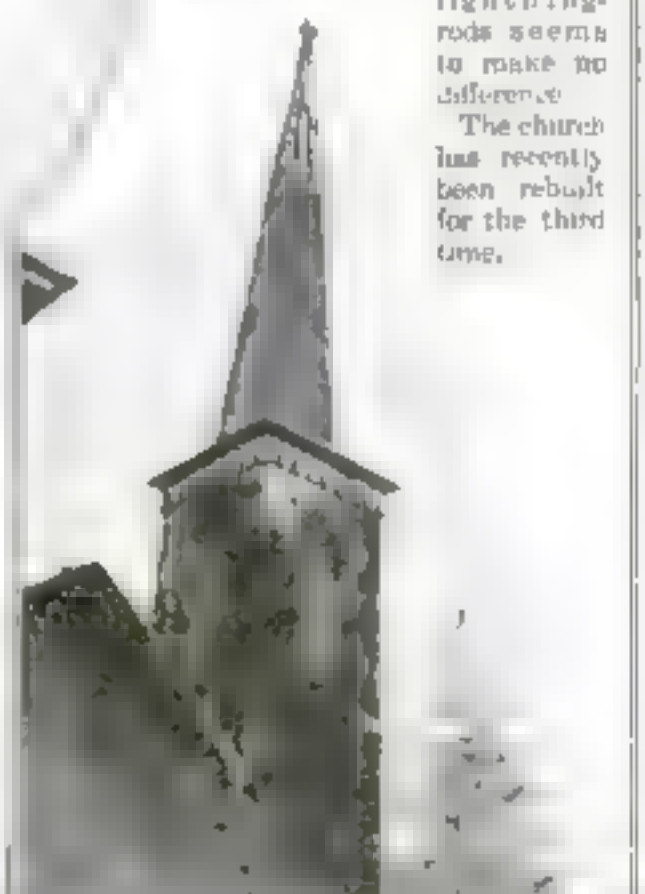
A photographer near by snapped the picture above just after Professor Newell jumped

Where Lightning Struck Three Times

THAT comfortable little thought about "lightning never striking twice in the same place" has all gone glimmering to the scrap-heap. The belfry of the Congregational Church of Poughkeepsie, N. Y., did it.

This long-suffering church has been struck three times: in the summer of 1872, in 1914, and again in 1918. The presence or absence of lightning-rods seems to make no difference.

The church has recently been rebuilt for the third time.



Bolshevism by the Car-Load

BOLSHEVIK propaganda—here's the way it is spread in Russia. A freight-car is loaded with Bolshevik pamphlets and books and a few Bolshevists thrown in. On the outside of the car the Bolshevik platform is painted in large letters. A train of these cars starts out, and one car is dropped at each town, where it stays for several weeks.

As the curious inhabitants gather around, the Bolshevists within the car hand out pamphlets and leaflets of all descriptions, with the idea of stimulating a taste for more. Then, when the villagers return, fired with a zeal for learning, text-books are displayed. After some question-answering and a good deal of parleying the books are bought. Thus the Bolshevists make money, and at the same time they add new Bolshevists to their ranks.

A Coal-Mine Worked by Hand

IF you sympathize with those who get the coal out of the ground, put at the head of your list the Chinese miners. They have no machinery to help them and must work their mines entirely by hand. There are no elevators to carry them down into the mines, so they climb up and down, aided by a wooden ladder that is laid flat on the ground.

Below you see a Chinese miner climbing out of a coal-mine and carrying behind him a great chunk of lignite. In spite of the primitive methods used in this mine, it is said to produce large quantities of coal

The mine is located near Peking, in the province of Shansi, where, it is estimated, there is enough coal to last the world for several thousand years at the present rate of consumption.

Should the dirigible be forced to make a landing on the water, this small collapsible life-boat can be blown up in three minutes; it will support fifty people

A Life-Boat for the Sea-Going Dirigible

"GO for a ride in one of our airplanes—price only $15; this includes life insurance."

The last two words of that advertisement—life insurance—suggest why flying has not become a popular sport. It is too dangerous for the average man to enjoy.

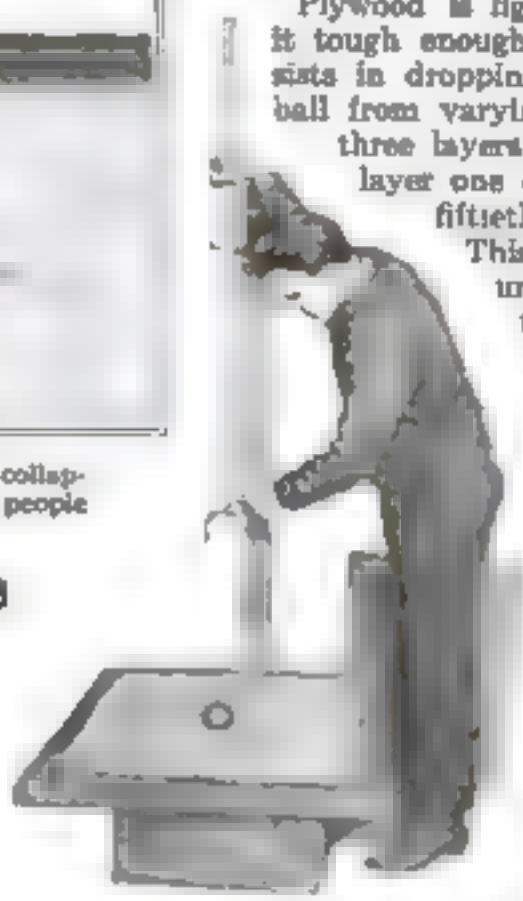
Germany contemplates starting dirigible air service to foreign ports, and she offers, as an inducement to the timid, the collapsible boat shown above.

When this boat is blown up it will support fifty people, even though it holds but about ten; the other forty must float in the water and cling to it. When the air is released it may be folded up to fit in a very small space. It takes but three minutes to blow the boat up. Our picture shows the boat just after it was launched from the dirigible in a test that took place on the Muggensee Lake near Berlin.

Can Wood Be Used for Airplane Wings?

AN airplane's wings must be tough and light. Varnished linen has filled the bill heretofore, but today the Government Forest Products Laboratory is experimenting with plywood—thin sheets of wood placed one on top of another with the grain crossing alternately, glued, and then dried under pressure.

Plywood is light enough; but is it tough enough? The test consists in dropping a heavy metal ball from varying heights on to three layers of plywood, each layer one one hundred and fiftieth of an inch thick. This will be continued until the toughest type of plywood has been discovered.



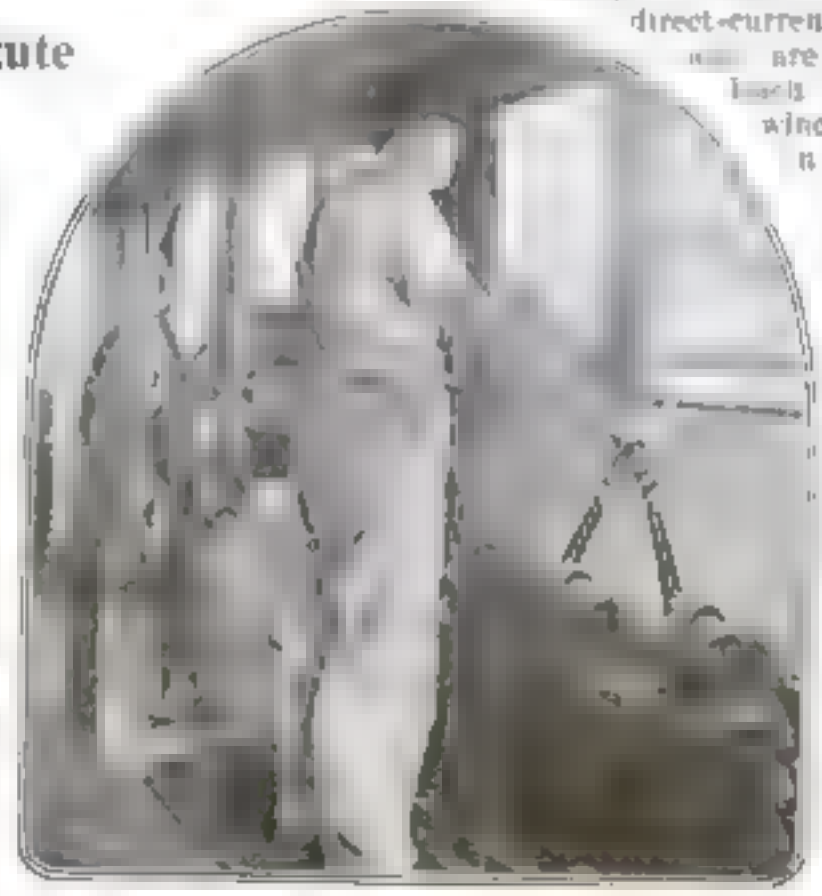
He opened the clamps and let the ball drop—it broke through the thin layers of plywood. In this fashion different kinds of plywood are tested for toughness

Acetylene as a Substitute for Gasoline

WHERE hydro-electric power for making calcium carbide on a large scale is abundant, as for instance in Switzerland and the United States, acetylene may be substituted for gasoline in automobile and power-boat engines.

Careful investigations show that by diluting the acetylene with from twenty to twenty-five per cent of alcohol, gasoline, light tar oils, naphthalene, or a mixture of light tar oil and alcohol in equal parts, the explosive power of acetylene is sufficiently diminished and if enough air is admitted to the carburetor, the clogging of the engine by unconsumed carbon can be prevented.

The acetylene, obtained from a solution in acetone, may be carried under pressure in iron cylinders.



With the work that is to be done in full view, the pilot operates the master switches of the electric hoist from any side of the pilot-house

Electric Hoists for Lighters

IN many modern lighter ships the old-fashioned donkey engines and clumsy winches that used to clutter the limited deck-space have been supplanted by electric hoists with an increase of about fifty per cent in efficiency. The steam plant for driving the generators and the motors is below deck. The motors are of the direct-current crane type, are entirely enclosed, and are equipped with magnetic brakes. Each motor is geared directly to its winch, and the winches are arranged in two rows, one above the other. The switches for controlling the hoisting apparatus are located in the pilot-house. They are in triplicate and are so arranged that the pilot can control the hoists from any point where he can obtain the best view of the operations.

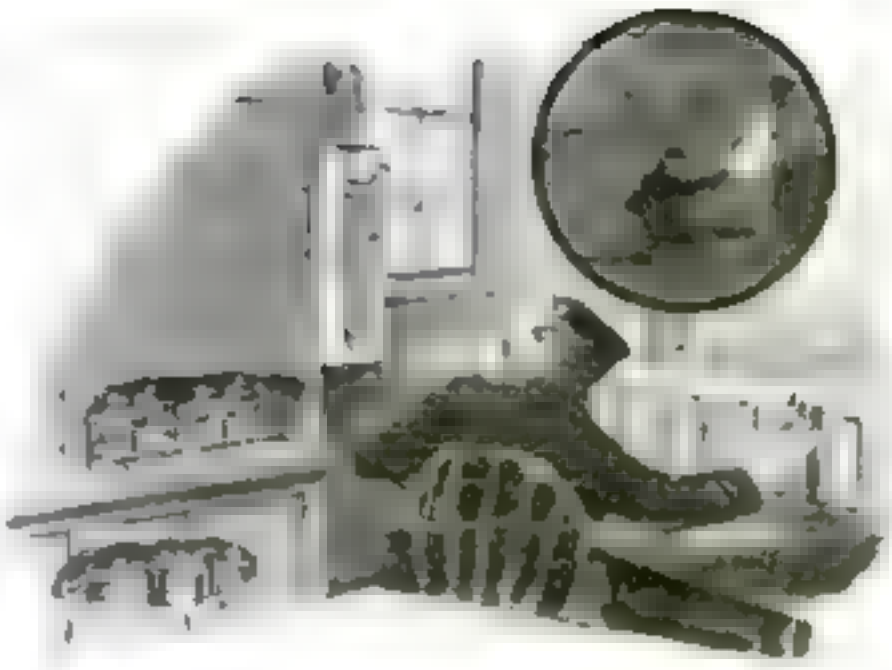
The controllers do not control the motors directly, but operate a series of magnetically actuated switches mounted below deck which make the actual connections.

When the pilot turns the master switch to the speed required, the magnetic switches close in the proper order and at a rate that will prevent the burning out of the motor while giving the maximum speed that is consistent with safety.

Making Safes Safe

Thereby causing an old art to become almost extinct

By P. Schwarzbach



Clang! A bell sounds and an indicator swings around another safe is being cracked! As the man in charge reaches for his telephone, he looks at his indicator-board to see which safe it is. A complicated system of wiring connects his batteries with the room in which the safe is kept the door, the windows, and the safe are all wired. What chance would Jimmy Valentine stand today?

REMEMBER Jimmy Valentine, the tender-hearted, nimble-fingered safe-cracker? Had he existed today, chances are he would never have become famous, but would have been nabbed on his first job. For invention has helped to make safes safe.

Let us suppose that Jimmy comes to life and decides to try his hand at a large safe of large content. He approaches stealthily, and discovers wires that indicate the presence of an alarm system; if he has had no experience with wires he may decide to cut or ground them.

In the first case he releases a relay by destroying the line current, and in the second he energizes another by increasing the current. In either case he unwittingly sounds the alarm.

"Ten years of hard labor," says the judge a few weeks later.

Suppose he ignores the wires and boldly forces the door of the room in which the safe is located? Again a relay is released and the alarm sounds in the central office. Or should he try the window, either by opening it or smashing the glass, the result will be the same. Raising the window trips a spring that breaks the circuit, and smashing the glass severs a tinfoil strip that is also an important part of the circuit.

The Central Burglar Alarm

This complicated system of circuits and switches is known as the "central burglar-alarm system"—nor does it stop at the windows and doors. Suppose Jimmy should miraculously get inside the room without disturbing the switches? He approaches the safe and kneels down before it.

Foiled again! There is another circuit-breaker under the rug that will quickly report to headquarters.

And the last circuit-breaker is in the safe itself, when the burglar starts to drill or melt a hole in the safe, a resistance wire within is either cut or fused, and the alarm sounds once more.

A Safe that Whirls

And now for another safe safe, invented by Patrick Meehan, of Brooklyn, New York, that is known as the whirling safe. When the owner of the safe decides to close up for the night, he starts a motor located beneath his safe and below the floor. The safe, which stands in the corner of the room, starts whirling, and at each revolution a light flashes and a bell rings.

Jimmy decides to try his luck at it. He stands watching it for quite a while; there is no one passing by outside. The safe is whirling too fast for him to try his hand at the combination; it is located in the corner close to the wall and there is no chance of his hanging on while it whirls—he would be knocked off and thrown down violently.

There are just two possibilities: he can stop the motor or climb to the top of the safe and drill through it. But, if he stops the motor, the light that flashes and the bell that rings at each revolution will stop too, and the neighbors will know that something is wrong.

Jimmy figures that his best plan is to drill through the top. He climbs up the frail latticework behind the safe and breaks away the part that covers the top of the safe.

Clang! A loud alarm rings throughout the building. Jimmy jumps down, and flees just in time to save himself from another ten years in prison.

The breaking of the latticework caused the alarm to sound. As Jimmy thinks it over he is sorry that he didn't risk stopping the motor, instead. But if he had the result would have been the same; for the whirling safe is equipped with a second alarm that automatically sounds when the supply of current is tampered with.

The whirling safe. At each revolution a bell rings and a light flashes. The burglar can't try to work the combination he dares not stop the motor since the light and bell will stop too. What is left for him? He might climb the latticework behind the safe and jump on to the top of it by breaking away the part that covers the safe- but the result? An alarm will sound throughout the building

Helping Out the Watchman

One of the oldest, simplest, and best methods of guarding a safe is to have a watchman keep a constant eye on it. But suppose the watchman should be called away for a short while? Well, there has been invented a safe-protector that will guard the safe while he's gone. It was invented by George C. Smith, of Cambridge, Mass.

The watchman estimates the amount of time he will be gone and the hour at which he will return. He then sets an indicator at the time he expects to return, adjusts a weight attached to the clock, and goes out, quietly shutting the door after him.

Trapped! As the burglar crosses the room the safe drops through the floor. Fearing a trap, he rushes back to the door to get out—but a second door swings shut behind him. How does all this happen? The opening of the door forces a projection in front of the door down into the floor; a series of levers does the rest

The weight causes a projection behind the door to rise up when the door is shut. If no burglar tries to force the door, the projection will hold its raised position until the hour at which the indicator is set. At that time a shifting of weights will cause the projection to drop back beneath the floor level, and the watchman may enter without having anything unusual happen.

But suppose Jimmy should try his luck in the meantime? He opens the door cautiously, and the raised projection in front of it is forced down. When he is half way across the room the safe suddenly drops through the floor!

Jimmy realizes almost at once that he is in some kind of trap, and rushes back to the door. But by the time he gets there a second outside door has swung shut, and he is neatly caught.

All he can do is jump down after the safe and sit on the edge until the police come to take him away.

What It Was that Happened

A series of levers caused the safe to drop when the projection was forced down, which in turn swung the trap-door shut. The inventor suggests that the safe be made to fall on cushions, so that it won't be damaged by its drop through space.

But why endanger the safe and perhaps the lives of the police who come to get the burglar, argues one inventor? It is not necessary, says he. According to his plan, you knock out the burglar before you go after him. As the burglar opens the door of the safe a small hammer drops down and breaks a bottle containing strong chemicals, the fumes of which will promptly knock the burglar out and keep him unconscious for several hours. In the meantime you cart his limp body to the police station.

If these different inventions are put into effect, safe-breakers will be forced to go into the second-story business.

He spreads out his tools, unconscious of the fact that he soon will really be unconscious. When he swings open the door of the safe, a hammer will drop down and break a bottle containing strong chemicals the fumes will knock him out for several hours. When he comes to he will be in the police station

Turn the Switch and Heat Your Bath

APARTMENT dwellers in big cities, accustomed to hot and cold water, electric lights, gas ranges, and other modern conveniences, sometimes forget how much comfort these conveniences mean to them and how much less fortunate are people who live in the country, where conditions are comparatively primitive.

Often it is necessary, under these conditions, to pump the water at a pump in the yard, heat it in a kettle or pan on the kitchen range, and pour it into the tub, continuing this procedure until there is water enough for your bath.

How often would you be inclined to bathe if you were compelled to do all this preparatory work every time?

The difficulties are not quite so great where electric current is available. Farmers whose houses are lighted with electricity may enjoy the luxury of a hot bath without much trouble if they provide themselves with electric heaters. One of the simplest electric heaters in the market is that shown in the accompanying picture.

Three carbon electrodes, in the form of rectangular plates, are bolted together in a parallel position, about three quarters of an inch apart, by means of an insulated bolt. They are suspended by conducting rods from an insulating bar and have at their upper ends connecting posts, to which the electric wires are attached.

If the carbon plates are submerged in the water and the electric current is turned on, the water in the bath-tub will quickly be heated. If one of the two outer electrodes is cut out, the intensity of the current will be reduced to fifty per cent; if the middle electrode is disconnected, to thirty per cent of its initial power.

With a current of 220 volts and from 20 to 34 amperes, 250 quarts of water may be heated to bath temperature in about an hour.

The same principle is employed in a can for heating water, coffee, or other liquids. The electrodes are in the form of concentrically placed cylindrical rings. The heater requires a current of 220 volts and 25 amperes and heats the water or other liquid, poured in through the tubulature near the bottom, in a few moments.

Submerge the electrodes in the water of your bath tub, turn on the current, and in an hour your bath will be ready

Here you see the single rails in place just before the concrete is poured in they are bolted to the ground

When a curbing is needed a double rail is used The curb above is finished and the rails will soon be removed

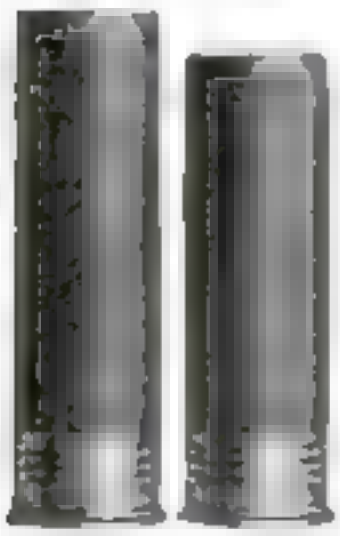
Rails that Help Make Concrete Roads

MORE and more are concrete roads being built, and with them come new steel forms of many kinds for supporting the concrete while the roads are under construction. The pictures above show two different kinds of steel rails that are being used by a large road construction company.

The simpler of the two, the single rail, has what is known as a slip-joint connection for joining rail to rail. At one end of each rail there is a metal projection held in place by a steel strip that is riveted to the top and bottom flanges of the rail. At the other end there is a groove into which the neighboring projection fits. The steel strips that form the groove and the other steel strip that holds the projection of the near-by rail in place, extend beyond the edges of the flanges and have holes in them to receive the stakes that fasten the rails to the ground. The rails are kept in place until the road is finished and the concrete has hardened. Then they are removed and used over again.

The double rail is used when a curb is to be built. The taller rail is bolted to the ground and the shorter one hangs from a "spacer" that connects the two. The spacer has a bolt-hole in one end and two grooves in the other end. A bolt is run through the hole in the spacer and through a hole in the suspended rail. One of the grooves in the other end of the spacer is bolted to the large rail.

When the curb is finished the suspended rail is removed first. This is done simply by unbolting the groove in the spacer and lifting spacer and rail together.



This is the same shell, before and after firing Note the increased length and flattened grooves of the shell that has been fired

The Reason Why Shotgun Shells Are Grooved

WHIR-R-R! *Bang! Bang!* Missed again. As you reload, your eye falls on an empty shell and it occurs to you that the grooves in the brass cap seem to be rather flattened out. On comparison with a loaded shell this proves to be true.

Do you know why the grooves are made in the cap? No? If they weren't there the paper tube would "cut off" from the brass cap.

When smokeless powder first came into use for shotgun shells there was endless trouble on this account. At the moment of explosion, the expanding gases jammed the cardboard against the sides of the barrel, while the brass cap was forced back against the breech bolt, thus tearing the paper tube and the brass cap apart.

Finally it occurred to one of the big manufacturers to stamp grooves in the sides of the brass cap to allow it to lengthen slightly without separating from the paper tube. This was done, and the cutting off ceased. The illustration gives an excellent idea of the increase in length of a shell after being fired.

Here's the Way We Wash Our Rugs

WITH hands clasped before her, the lady in the picture below and at the left leans over the machine on the floor, a joyful smile flooding her face.

You really can't blame her, for, right before her eyes, her dirty carpet is being washed as if by magic.

An electric machine, which looks like a vacuum cleaner laden down with milk-cans, is doing the work. The cans contain, not milk, but soapsuds that are fed to a pair of rotating rubber brushes below.

The rubber that is used in these brushes is soft and in consequence they penetrate the nap of the carpet to its very roots.

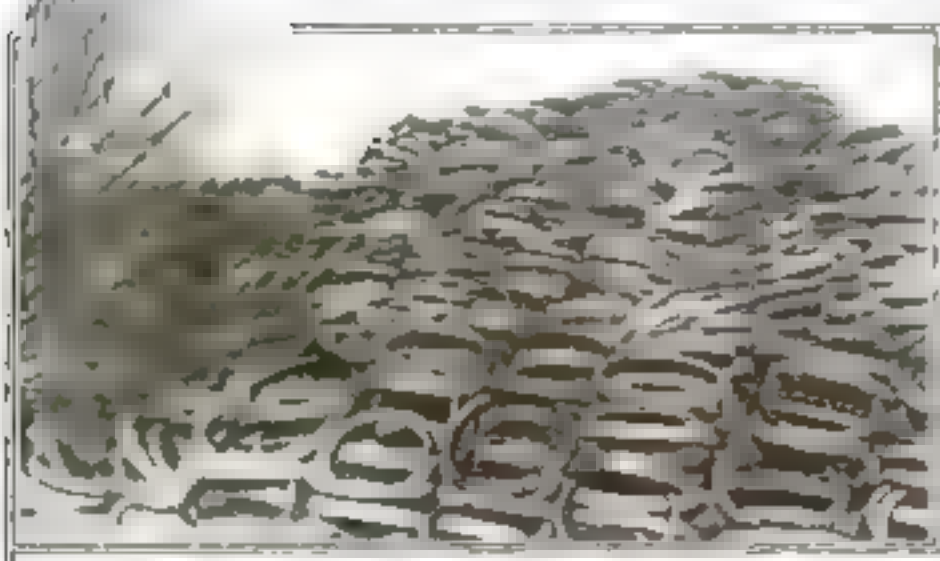
The soap compound contains no harmful chemicals or animal fats. It is made, according to a strict formula, from vegetable oil. Besides lengthening its life, this gives the carpet a fresh, sweet smell.

The brushes rotate at a rate of five hundred revolutions a minute and scrub a rug much more quickly than the human hand could possibly do it. Besides, the job is not a dirty one—note the clean white jacket on the man who is pushing the machine around.

The new rug-washing machine is operated like a vacuum cleaner rotating rubber brushes with the aid of soapsuds make a carpet as clean as when new

Cleaning Up After the A. E. F.

All sorts of [illegible] rumor had it that the government simply gathered together most of the airplanes in France, removed the [illegible] and [illegible] what was left [illegible] the government. [illegible]



Trees have not [illegible] and one sees [illegible]

You see [illegible] from the [illegible] and [illegible] Caterpillar [illegible] I [illegible] these wagons were [illegible]

Here you see some of the burning airplanes that were purposely fired in the general cleaning-up process in France. The government says that only those parts that could not be sold or used were destroyed in this bonfire, and that the financial loss was not very great. There is a law that prevents the government from giving anything away

When the Human Herd Stampedes

If you are skillful with a lasso take a rope with you and hurl it at an [illegible] normal

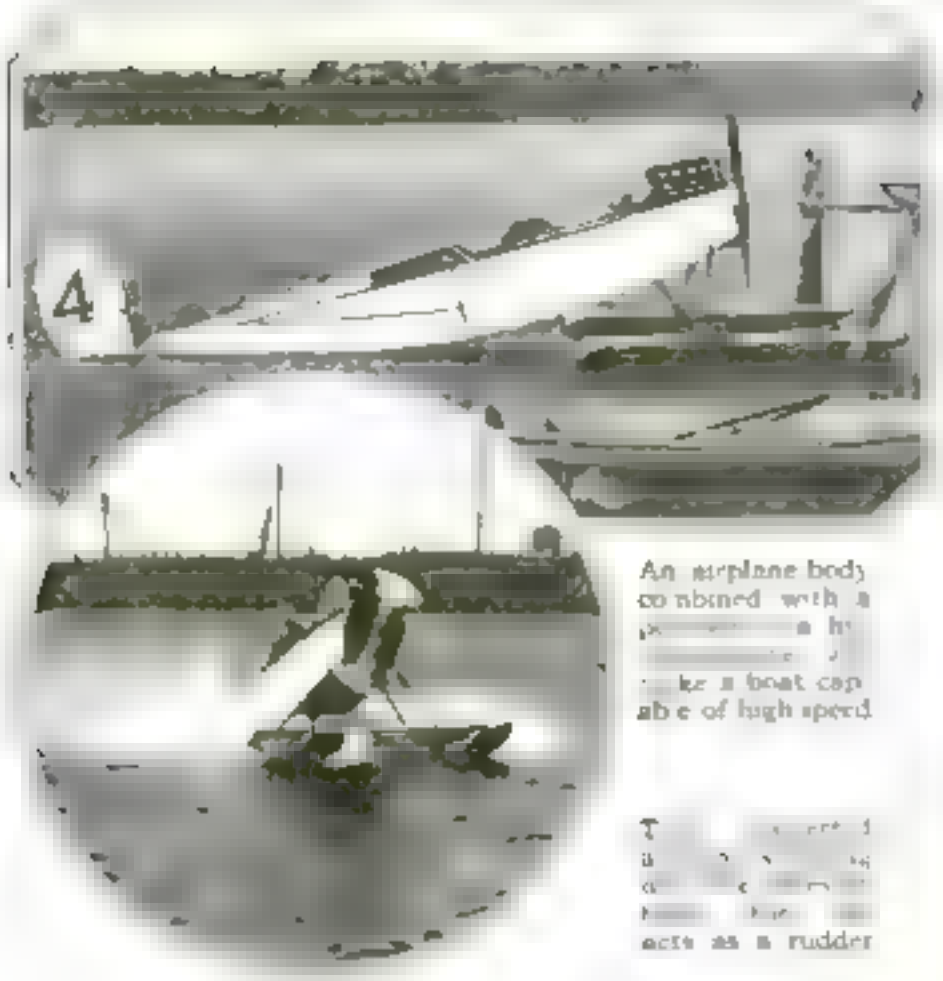
Once you've got him you [illegible] a bag over his head and [illegible] He won't get very far with [illegible] his eyes and arms

From the way he is biting on that [illegible] and clenching his hands, [illegible] helpless

Caught and bound by means of a lasso [illegible] the weight keeps it going and you have [illegible] completely tied up

The crowd-punchers circle the mob, [illegible] a club in each hand [illegible] so that their clubs just touch. Thus a small number of men can close in on a large crowd

Carry a shield in your left hand to ward off bricks and stones, better still [illegible] strap it [illegible] your arm and thus have two free hands with which to work



An airplane body combined with a [illegible] makes a boat capable of high speed

[illegible] acts as a rudder

Out of the Air into the Sea

WHEN an airplane's flying days are over and it is pronounced unfit for service, must it die in the strap-heap? Not necessarily; it can shed its wings and become a boat without much trouble. All it needs is a cast-off pontoon of a hydro-airplane on which its bow end is pivoted

Such a boat is shown in the pictures above. The propeller, body, engine, and tail came from an airplane, the pontoon from a hydro-airplane. The tail is used as a rudder and is controlled by wires leading to the cockpit. With its hundred-and-fifty-horsepower motor it can travel at a speed of fifty-five miles an hour.

On account of its aerial propeller it is able to run in shallow, weedy water where an ordinary motor-boat would become badly entangled.

How Fast Does a Bird Fly?

RECENTLY an English naturalist rigged up screens of very fine silk and wire threads, and with this contrivance he was able to record the speed of birds flying through the screens in exactly the same way that the speed of a bullet is measured

He found that blue rock pigeons did from twenty-six to thirty-three miles an hour, the speed varying in individuals; that English pheasants at their best did thirty-three and eight tenths miles an hour, and that the English partridge's speed ranged from twenty-six to thirty-four miles an hour.

Carrier pigeons timed in long-distance races have been found to range in speed all the way from fifteen miles to fifty-five miles an hour. The average speed of the carrier pigeon has been estimated to be thirty-five miles an hour.

The House of Straw and Clay

BERLIN and New York have one thing in common — the lack of proper housing facilities for their thousands of workers. New York's excuse is, chiefly, high cost of labor and material; Berlin's excuse seems to be lack of material.

And the outcome? Berlin is using new and different materials. Below you see a house of clay and straw under construction. It is one of many such houses that are springing up in the suburbs of Berlin.

Clay with bits of straw sticking out is not a pretty sight; but if it keeps the cold out in winter, it will be found worthy. The [illegible] straw helps the clay adh-

Owing to the lack of building materials, houses of clay and straw, mixed, are now springing up in the suburbs of Berlin

An Electric Divining-Rod

A NEW electrical divining-rod, if we may use the term, for locating buried iron, has been invented by a French scientist. Its object is to discover unexploded shells buried in the fields of Flanders, that constitute a source of danger to agriculturists.

The apparatus, with slight modifications, is also serving industry; for it is now being used to locate buried water-pipes and valves.

The working of the Hughes induction balance, as it is called, depends upon the strength of the current in two induction coils remaining equal, or balanced. The coils are situated as shown in the picture, one in each of the rings that you see resting on the ground. They are both supplied with alternating current from the same source, and consequently both carry exactly the same amount of current in the ordinary way. While the current remains balanced in this way there is no sound to be heard in the telephone receiver that the operator is using.

When, however, a piece of iron is brought into the vicinity of either coil, the balance is upset, and sounds may be plainly heard in the receiver.

By moving the balance about and noting the strength of the sounds, the exact location of the buried iron can be determined.

Thus has science, instigated by the war, brought the immemorial hazel-twig divining-rod up to date.

Contrived for locating buried shells, that after-math of the war so dangerous to agriculturists, this electric divining-rod is useful in finding underground pipes

A Power Plant on Wheels

"WELL, Jim," said the boss to the foreman of the machine-shop, "here's a power unit that will work all the old hand threaders—no alterations, either—and do the job in just one eighth of the time it takes us to do it now."

He indicated a one and one half horsepower electric motor that he was trundling along. It is a machine which was specially designed to be moved about to any place at which its services are required, and, although it weighs over two hundred pounds, it is so nicely balanced that one man can handle it with ease.

The motor is controlled with a simple switch and has a two-speed gear. The speed is changed by merely pushing in or pulling out a knob.

No universal joints or chains, or other cumbrous mechanism are used, for any differences in height or distance are taken up by simply running the unit backward or forward on its wheels.

Existing hand tools do not have to be changed in any way for use with this new drive. It is just a strong, adaptable, convenient right arm of metal.

This portable motor will operate existing hand tools, no changes being necessary

You detach the fasteners on these suspenders, and the suspenders are then turned into a belt, buckled with the same buckles that originally held the fasteners

The Metamorphosis of a Pair of Suspenders

THE comfort of suspenders and the beauty of a belt—how can you combine these two so that the fat man in the office may take off his coat in hot weather? A Canadian manufacturer has solved the problem by making suspenders that may be quickly and easily turned into a kind of double belt.

The three sets of fasteners that are attached to the suspenders are unbuckled when the suspenders are to be transformed. You tuck the fasteners carefully in your pocket, so they won't get lost, and wrap the remainder around your waist. The buckles that once held the fasteners are now brought together, buckled and your suspenders have become a belt. The most satisfactory material is rubber webbing, though leather is also used.

Our illustration shows an erstwhile belt on its way back to suspenderdom. The last pair of fasteners are being clipped into place.

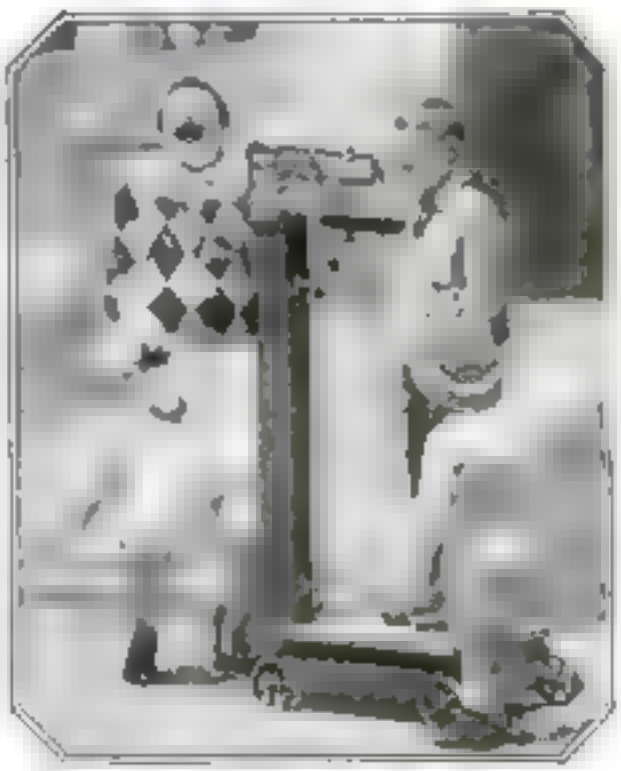
Copyright, Wide World Photos

The man who appears to be peering through a telescope is really looking to find out how hot the furnace is

How Hot is the Furnace? Ask the Pyrometer

THE electric furnace is the magic crucible in which modern alchemists perform their wonders. The one shown in the picture above is of the "tube" type.

It is often necessary to know the temperature of the contents of the furnace, and for this purpose an instrument called an optical pyrometer is used. That is what the man sitting down is using. He is looking at a brightly glowing, or incandescent, body inside the furnace. The instrument measures the light that the incandescent object gives off, which varies with the temperature. By making a certain calculation he is then able to determine the temperature of the furnace.



This is Cho-Cho, the great health clown, whose business is to laugh school children into taking good care of themselves

He Is Called Cho-Cho the Health Clown

"IF you want to be healthy, eat plenty of carrots, spinach, asparagus, and lettuce." Your pale, thin, anemic, cranky school-teacher told you that many years ago and, as usual, you paid no attention to her. But if a clown had danced into your class-room, carrying on his arm a basket of vegetables which he placed on the desk, and had taken out of it a carrot, some spinach, asparagus, and lettuce, you would have been all attention. And if after cracking jokes and making faces he had extolled the virtues of the carrots, you would have run home from school and demanded carrots for dinner.

The tale of the clown is not a wild dream. His name is Cho-Cho and he knows what he is talking about for he has spent years in studying the laws of health.

By his antics and games he impresses on the children the proper things to eat and drink, how often to bathe, and how to keep and play.

This little stove will heat water or milk and can be taken apart and carried in your pocket or your grip with no danger of leaking

Slip a Stove in Your Pocket

LOOK at the pictures. Just a nurse and a spirit-stove? Yes, but this stove will burn liquid fuel without any danger of explosion, and can be carried in your bag or pocket without leaking.

There are only three parts: the reservoir, which carries a tin collar, the burner, and the boiling-pan. The burner is interesting because it does not burn from an ordinary cotton wick. The wick is flattened out at the top, and is brought into contact with an asbestos pad. The spirit soaks into the pad by capillary attraction, and a large indestructible burner is thus formed. The flame will boil water in a few minutes.

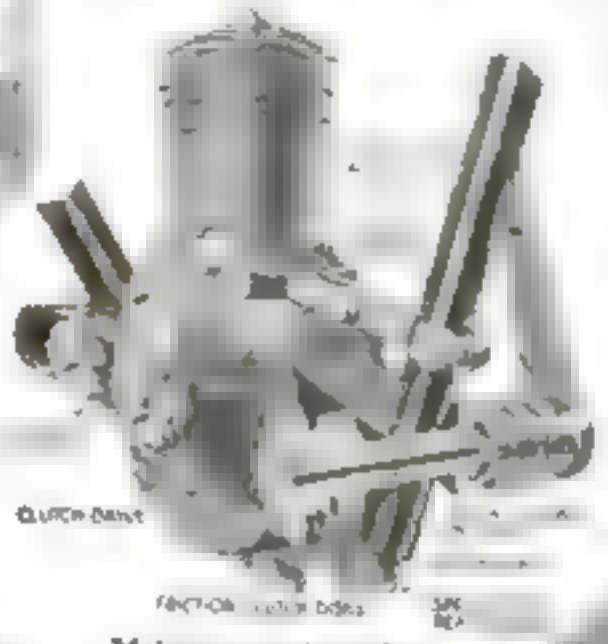
Another Motor Bicycle

EVERY morning Mr. Tyvald Christensen, of Staten Island, N. Y., motors down the street on his bicycle. There's nothing unusual about a motor-driven bicycle, but this one of Mr Christensen's is different from all others. He made it himself

The motor does not trot along beside the rear wheel, but is neatly tucked in between pedals and saddle.

There are three great differences between this motor and the usual bicycle motor. It has a clutch, the magneto or current generator is run separately; and the muffler was removed from its place in front of the cylinder and placed underneath the crank-case.

What are the advantages of these changes? The clutch and-chain drive gives the bicycle a smooth start. Running the generator separately obviates jerks and strains. The new position of the muffler gives the cylinder free circulation of air.



Making a motorcycle of a bicycle is easy, says Mr Christensen Instead of tacking on a third wheel he installs this motor on the machine itself

To remove a button you slip it into the slotted base of the button remover and press on the handles

Button, Button, Off with the Button

CLIP, clip! Off come the shoe buttons one after another In less than a minute you can strip a pair of shoes if you use the button-remover invented by John Baldwin, of Grand Rapids, Mich. You slip the button into a slot in the base of the device and press the handles together. Off comes the button, and with it the metal fastener that held it to the shoe—and the shoe is not torn

The slotted base is made in two layers—the upper one being part of the upper handle and the lower one part of the lower handle. When you press the handles together the base parts, jaw-fashion. The top jaw pulls the button and fastener upward and the lower jaw tends to flatten out the fastener so that it will open up and slip through the holes.

An Oak Tree for a Derrick Mast

"SAY, what's the boss looking at?" remarked one of the construction men who were erecting a cotton-mill up in New Hampshire. "He's been standing there chewing his stogie and staring at that oak tree for the last ten minutes."

Next day they found out the trend of the "supe's" thoughts when he announced that the oak tree was to form the mast for a derrick.

The mill was built in the center of an oak grove, and several of the trees had been left standing immediately outside the walls. It had occurred to the job superintendent that it would be a waste of time and money to erect masts for the construction derrick when a natural mast was already at hand

The boom of the derrick was secured to one of the sturdy branches with large timbers and heavy bolts, and the winding machinery was set up in a convenient position among the trees.

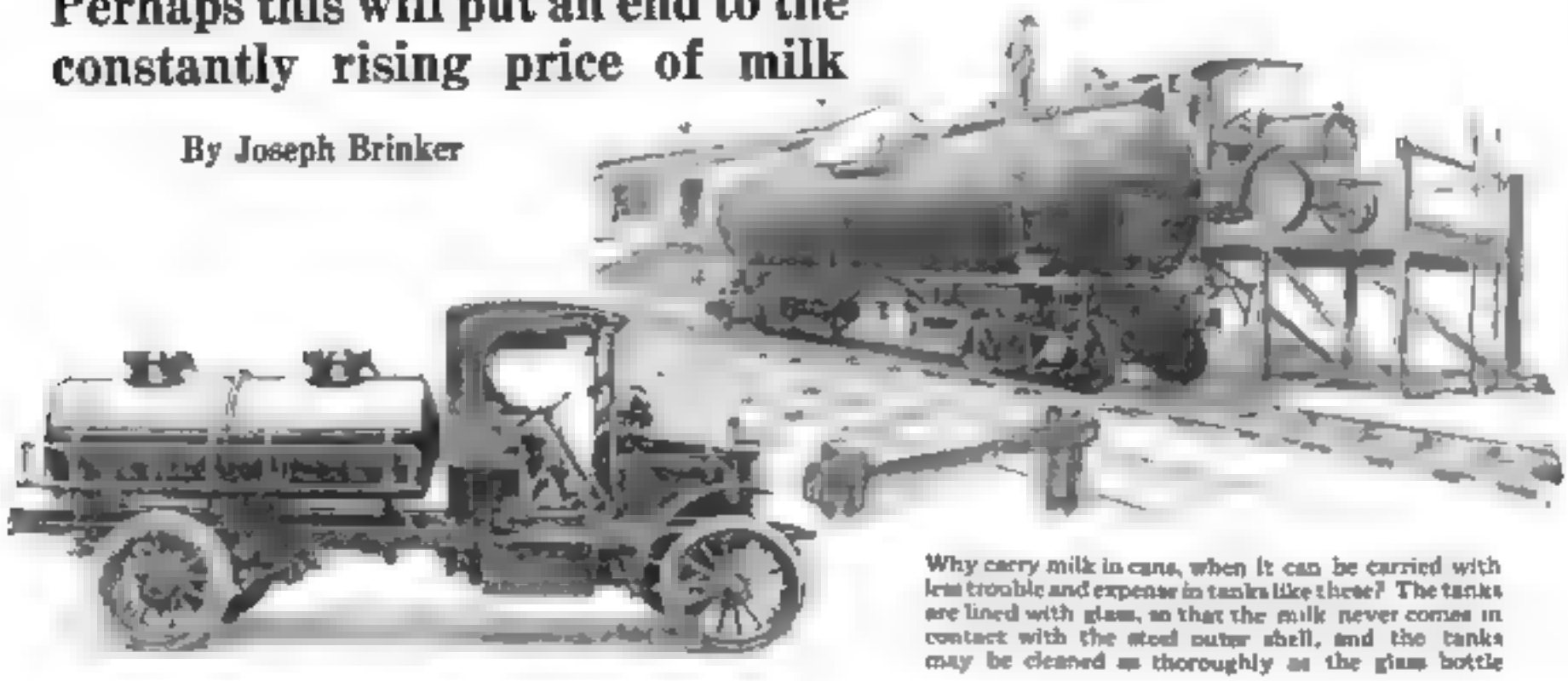
No real damage was done to the grove, as the trees used had to come down in any event for the sake of light.

By using a tree for a derrick mast one contractor saved time and money. It was hard on the tree but he chose one that had to come down anyway in order to let in the light

Carrying Milk in Tanks instead of Cans

Perhaps this will put an end to the constantly rising price of milk

By Joseph Brinker



Why carry milk in cans, when it can be carried with less trouble and expense in tanks like these? The tanks are lined with glass, so that the milk never comes in contact with the steel outer shell, and the tanks may be cleaned as thoroughly as the glass bottle

DID it ever occur to you that the cost of milk delivery is app oximately twelve per cent of the cost of that milk to the final consumer?

Milk is one of our basic food products. Its price is steadily rising higher and higher, and with it the high cost of living. The farmer blames the distributer and the distributer blames the farmer; meanwhile the price of milk continues to rise.

The cost of milk delivery may be divided into four parts. First, there is the cost of the haul from the farm to the railroad; second, the haul to the city depot by train; third, the haul from the railroad depot at the destination end to the city pasteurizing plant, and, fourth, the final delivery to the housewife. In the final delivery to the housewife, it is, of course, impossible to make the deliveries in bulk because the milk is bought in quarts. But in the other three phases of delivery it is entirely practicable to deliver in bulk instead of in small quantities.

Under the present scheme of milk distribution the farmer pours his milk into ten-gallon cans and hauls it or has it hauled to the nearest railroad to meet the milk train going to the nearest large city. It still remains in the ten-gallon can while in the refrigerator car, and when it is taken off and again hauled to the city pasteurizing plant.

Repeated Handling Adds to Cost

This means four separate handlings from the time the milk leaves the farm until it arrives at the pasteurizing plant. First, the farmer puts it into a ten-gallon can; second, the man who hauls it to the railroad siding unloads it into the milk-car; the third handling is the unloading from the freight-car to the truck to carry it to the pasteurizing plant; and the fourth, the unloading at the plant.

Now, it is a fair law of transportation that any kind of goods can be moved more cheaply in large units than in small ones. Furthermore, this principle has been put into practice to an extent that, though comparatively small, is sufficient to indicate the possibilities of revolutionizing the entire system of milk transportation.

The Tank Can Be Put on a Truck

This change will come about through the use of tanks carrying from five hundred to one thousand gallons of milk at a time. It seems patent that the cost of handling a gallon of milk in thousand-gallon lots would be less than handling it in ten-gallon cans.

The first place where tanks of large capacity can be employed instead of ten-gallon cans, without any considerable change in the existing equipment, is in the collection of milk from the farms and its transference from dairies to condenseries or the like, when no railroad haul is involved. In this class of work it is necessary simply to mount a milk-tank on a motor-truck, and the truck will do the rest. A truck equipped with such a tank is shown in the illustration above.

Milk concerns have not followed this plan before because they were afraid that carrying milk in tanks might lead to contamination caused by the contact of milk with metal. There is no longer any ground for such fears, for the tank shown in the picture is lined with glass and none of the fluid ever comes into contact with the steel outer shell. Furthermore, the tank may be kept scrupulously clean, for it may be flushed with hot water or disinfected with live steam in the same manner as are the glass quart bottles now.

This tank has a capacity of five hundred gallons. It is made of steel, lined throughout with a thick glass enamel. This enamel is fused into the body of the steel itself at a tremendous temperature, so that the finished material combines the strength and resistivity of steel with the easy cleaning qualities of glass. The glass lining extends over the flanges and to the outer edges of the filling man-holes at the top, so that at no time is the milk in contact with the metal. The tank is held firmly in place, so that the glass enamel will not be cracked while the truck is in motion.

Many such tanks as that shown are now in use to haul cream from the dairy to the creamery and to haul milk from the dairy to the bottling plant or condensery.

And Why Not a Tank-Car?

There is no reason why the same idea cannot be applied to railway transportation as well as to motor-trucks. We have oil-tanks and chemical-tanks on railroad cars. Why not milk-tanks? In fact, Mr. F. T. Craft, a milk dealer of New York, in testifying before a commission inquiring into the high cost of milk in that state, predicted that a combination motor-truck and railway-car tank service for handling milk in bulk would revolutionize the entire present scheme of milk transportation and would be one of the big factors in reducing the cost of milk to the final consumer.

By the use of tank-trucks in the country, tank-cars on the railroad, and tank-trucks again in the city from the railroad depot to the pasteurizing plant, milk handling could be put on a bulk basis.

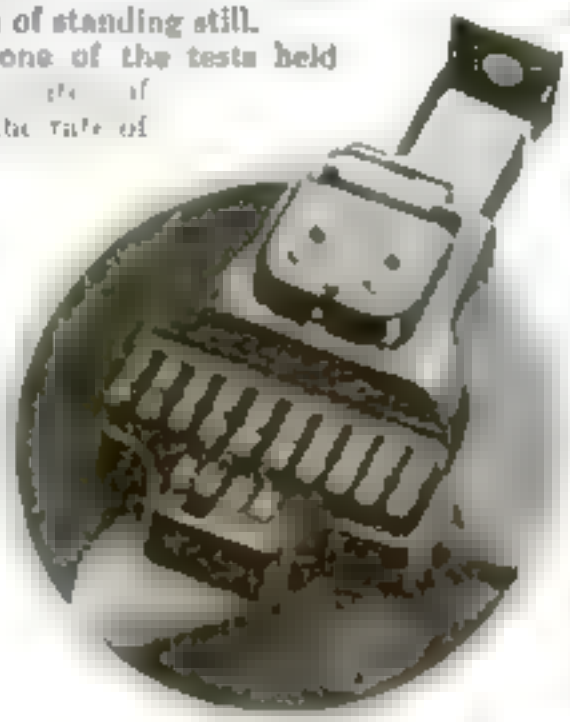
He is determining the speed of the motor's rotation by observing the spokes on a disk that revolves with the motor, through slits in a hood mounted on a vibrating tuning fork

What Is Its Speed?

WHEN another train is running beside the train you are riding in at the same rate of speed, you have the sensation of standing still.

This principle is used in one of the tests held by the Massachusetts Institute of Technology for determining the rate of a motor's rotation. Mounted on the shaft of the motor there is a white disk on which spokes like those of an automobile wheel—are painted in black.

You start the motor and watch the revolving disk through two slits in a hood that is mounted on the prongs of a vibrating tuning fork. You adjust the speed of the motor until the spokes on the disk appear to be stationary. Knowing the rate of vibration of the tuning fork, you are able to calculate the speed of the motor's rotation.

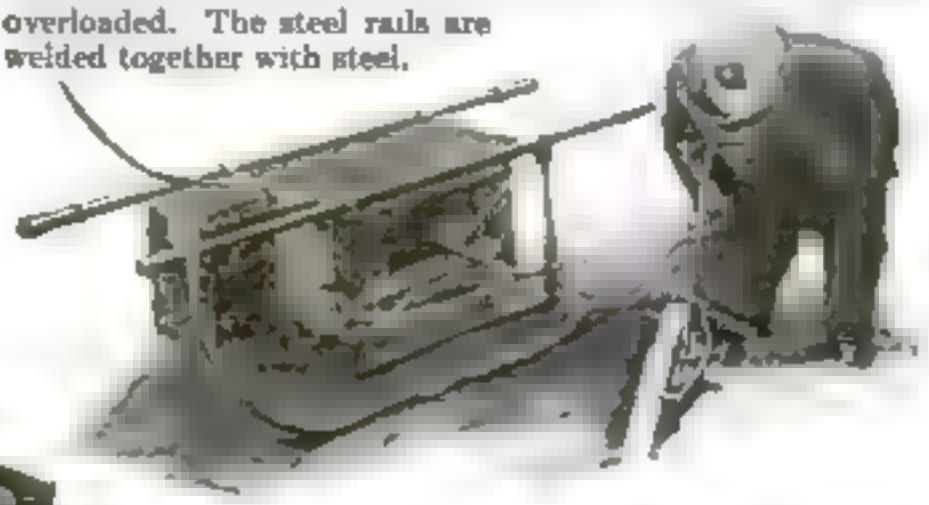


This machine, which weighs only four and a half pounds, will make legible, printed shorthand notes

Welding Tracks with a Steel Rod

CLINK, clink, clink—every time the wheels of your train cross a rail-joint you hear that clink. If you have nothing else to do you take out your watch, note the time between clinks and figure the speed of your train. But you won't be able to do it long, for they have taken to welding rail joints instead of leaving them open, thus safeguarding the lives of rails, wheels, and passengers.

A new welding machine and the welder are shown herewith at work. The machine is simply a cast-iron resistance-box having an automatic throw-out switch and a circuit-breaker that will shut off the current when the machine becomes overloaded. The steel rails are welded together with steel.



He welds the steel rails with a steel rod that he holds in his hands; it is connected with the resistance box

A Prohibition Launching

PERHAPS it was the bottle of mineral water we don't know but anyway the *Penguin* didn't even try to stand up when she was launched. She toppled right over. You see, it is quite possible that such a great disappointment at the moment of her debut was too much for her.

There is another reason, though, a more practical one. The launching was made sideways, and as the ship neared the water the stern fouled the ways. The bow swung out and the ship tilted to an angle of seventy-five degrees. Workmen cut away the interfering ways and the ship righted herself.

The *Penguin* is a steel trawler, one hundred and fifty-one feet long, and having a 26-foot beam. She has a speed of fourteen knots.

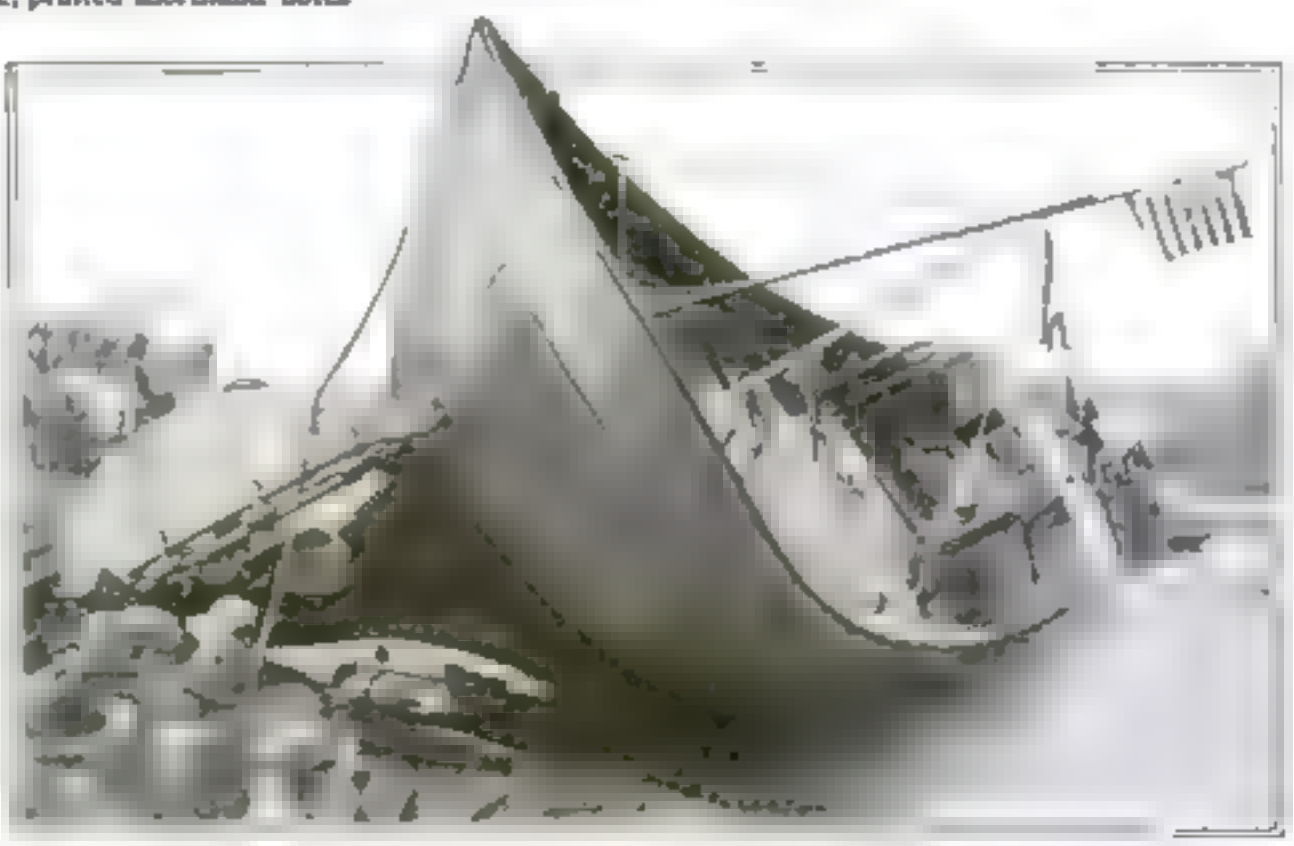
Taking Shorthand on a Machine

NO more agonizing over cold notes! A machine has recently been invented on which stenographers can take down shorthand in unmistakable and legible printed form.

The machine uses ordinary letters singly and in various combinations. The keyboard is arranged so that any or all the keys can be struck at one time, for the operator will frequently use three or six or eight or more keys at a time.

The stenographic notes are recorded on a long strip of paper that reminds you forcibly of that in an adding-machine.

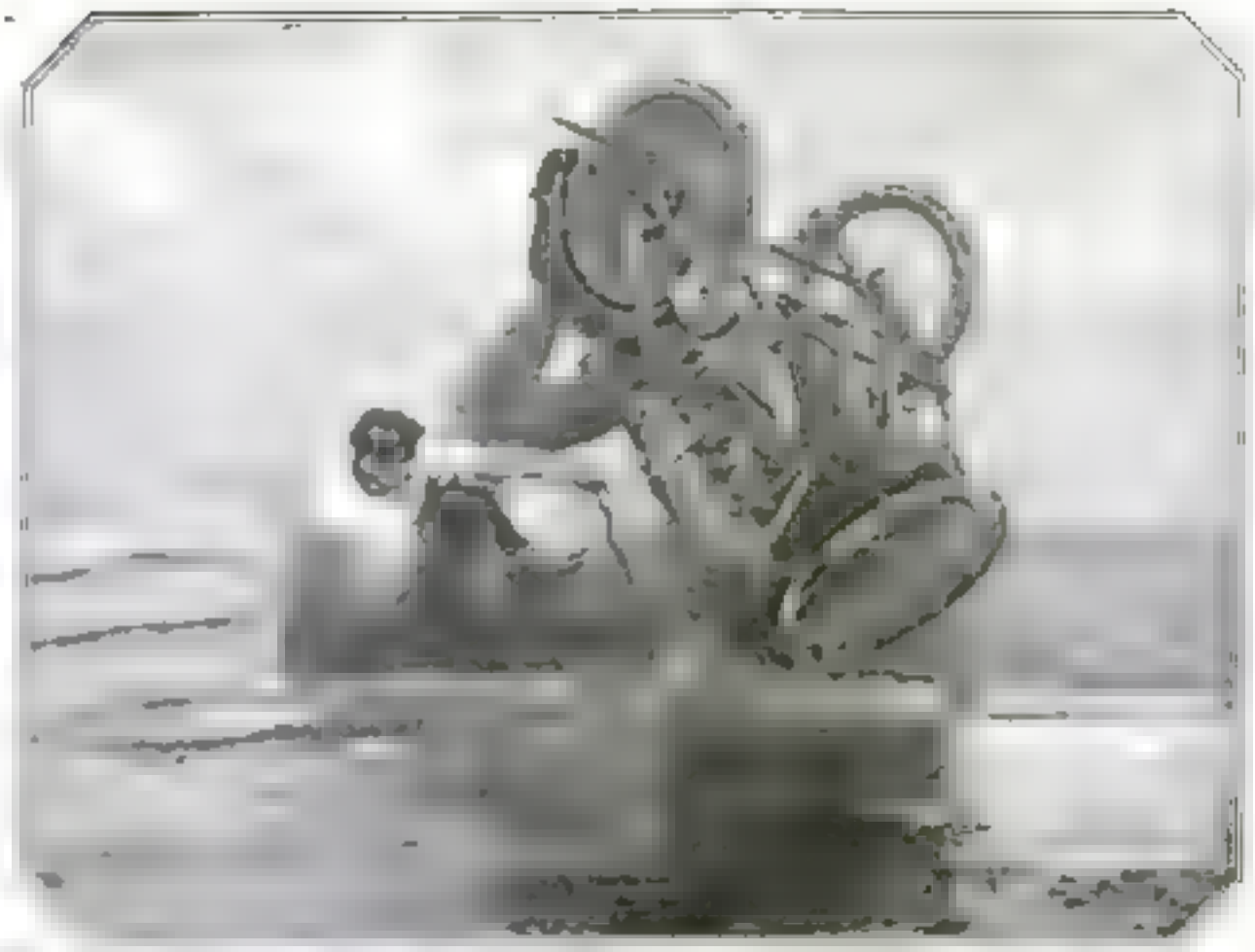
Consonants are written according to sound, and vowels according to spelling. It is stated that notes can be made as quickly as by hand, and much more legibly.



She was christened with mineral water, and she toppled right over when she hit the water. She was built in Cleveland, Ohio, at a cost of two hundred thousand dollars, and is the first steel trawler ever launched on the Great Lakes

Snapped as They Crashed to Earth

Traveling at terrific speed one false move will hurl the rider through the air



Kismet cleared the last fence and landed on his neck his feet flying in the air the jockey landed on his back several feet away Neither of them was hurt in this spectacular spill, which took place directly in front of the photographer's camera

The motorcycle, dashing across the sand hit a hole leaped into the air turned over as you see, [illegible] but his passenger in the [illegible] shot head first into the sand they were badly shaken, but fortunately [illegible] A [illegible] so right in [illegible] great power [illegible] a pure [illegible] youth

Keeping His Kit Up to Date

WHEN the modern yeggman is ready to start on a job, does he take stock of his kit to make sure that he has incorporated the latest ideas in tools? 'Twould seem so.

His most recent addition appears to be the oxyacetylene blowpipe. At a recent safe-cracking operation the burglars cut through the side of a perfectly good burglar-proof safe in a most nonchalant manner with the aid of this tool. They then blew out the lock with nitroglycerine and helped themselves to the loose cash in the safe.

Even the scientific burglars strike a snag now and then though, and a manganese-steel-lined safety box was proof against the persuasive powers of the oxyacetylene. The criminals left behind them a large hammer and two cylinders of gas. The police subsequently discovered that these too had been stolen.

Our picture shows the hole they burned in the safe, together with one of the gas-cylinders. The cracksmen made use of the property of the firm they were robbing in a most promiscuous fashion, helping themselves to everything they required, from baking-soda to the employees' clothes.

This burglar-proof safe was burned through by the use of an oxyacetylene blowpipe Then the lock was blown out with nitroglycerine

Things that Cotton Will Make

MOST of the so-called tortoise-shell rims that are put around eye-glasses never had anything to do with a tortoise. What are they made from? Cotton! In fact, many umbrella handles, hairpins, combs, buttons, buckles, bracelets, and covering for French heels are also made from cotton. This sounds strange, doesn't it? Nevertheless, it is true.

The cotton is first turned into tissue paper; this is threaded, dried, and dusted. Next the paper threads are dipped into a mixture of nitric and sulphuric acids. The water is pressed out of it and the remainder is ground fine. It is mixed with other things to form a doughlike mass.

Under hydraulic pressure the dough is kneaded and molded into cakes. The cakes are sliced and hung up to season. Dies cut the material into its final form and it is shaped, polished, and drilled.

While the material is still plastic the proper dyes are added. The most common colorings are imitation ivory, tortoise-shell, and pearl. We can add to the list of cotton-made goods mentioned above, ivory and tortoise-shell dresser sets, "shell" tops for handbags, and even the covering for shoe eyelets.

The Flash-Lamp that Needs No Battery

When he pulls the chain the light will flash for five seconds, this flash-lamp has no battery—it generates its own electricity

Copyright International Film Service

SNAP! You turn on your flash-lamp and nothing happens. Its battery's dead again. It always seems to go dead when you need it the most. Can a flash-lamp be made that needs no bothersome battery? It can. The flash-lamp pictured here is one; it makes its own electricity. You pull the ring at the end of the chain; a spring winds up and the little armature within whirls around. This lights a two-candlepower bulb. One pull on the chain makes the light flash for five seconds. This is long enough to find your way around a sharp stairway, or to find a key-hole.

American doughboys in the St. Mihiel drive and afterward, captured a number of these contrivances. Some were found with handles like a conductor's punch. The Germans had them in and around their dugouts at points where they could be picked up conveniently for night excursions.

Doubtless many of these odd little generators found their way into this country as war souvenirs.

When you hit the letter "A" the arms of the doll move to the signal position "A"; thus you learn the signal system

Wooden Deer of the North

A STATELY pine, with a little fixing, can be made quite grotesque. If you doubt it, observe the pine here. Yes, it is a pine, though it looks more like a starving, weak-kneed deer. The body, legs, and tail are one slice of the pine tree, and the head and horns another.

The owner simply put the head and body together, nailed two axle-grease boxes to the head for eyes, and stood the creature on its legs.

It is a strange looking beast, but its master is quite proud of it since he discovered it. If you would like very much to see this wooden deer you will find it standing near the railroad tracks at a spot about a mile north of Minnekahta, South Dakota.

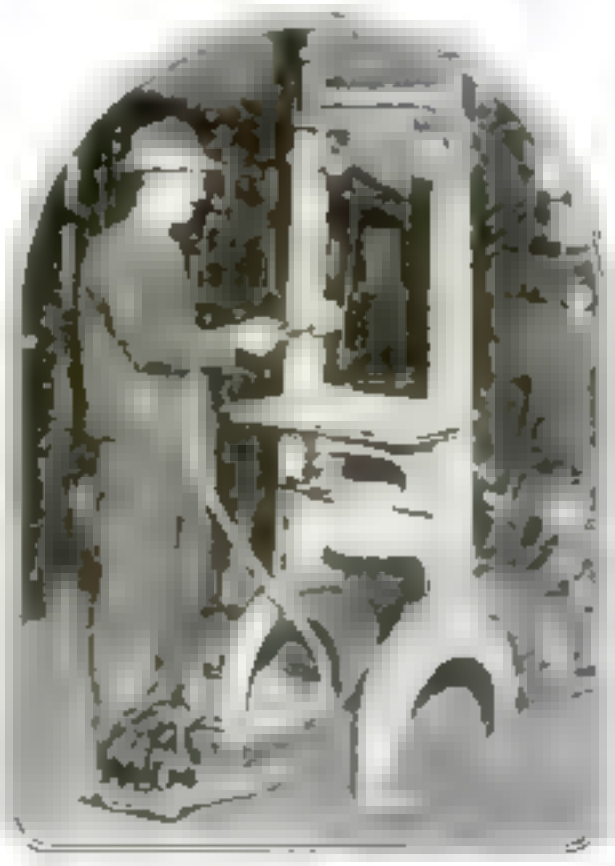
This wooden deer was formerly part of a pine tree: the body, legs and tail are one: the head was tacked on and so were the eyes

Bringing the Machinery to the Work

THERE are many drilling, grinding, and polishing operations that could be done much more economically by taking the machine to the work instead of the work to the machine. A portable power unit has been devised to cope with just such situations.

The machine consists of a ¼ h.p. electric motor, mounted on a base. It is equipped with a switch, a three-speed counter-shaft, and five feet of flexible shafting, which terminates in a tool-spindle. To use this machine it is necessary merely to connect it with the nearest lamp-socket.

The new unit is primarily designed to do away with the moving of large castings for the sake of performing small operations on them, but it is equally useful on small objects. It is easily portable, and comparatively inexpensive.



The little motor on the floor saves the cost of moving the big casting across the shop to the stationary grinder

This is a Wigwagging Typewriter

YOU'VE seen beribboned dolls tied to automobile radiators and dancing dolls bouncing up and down on talking-machine records, so you won't be surprised if you see athletic dolls fastened to typewriters and flinging their arms wide every time a key is struck.

Such a typewriter, with a man working at it, is shown in the picture above. It is a new way of teaching flag signaling. Suppose you wished to learn the signal alphabet. You would strike "A" on your typewriter and the doll's arms would fly to the wigwag position for "A"; and so on.

Strings leading from the shoulders attach the arms to a pair of parallel bars fastened at one end to the side of the machine. The other end is free to move downward under pressure. At right angles to the parallel bars and directly above them are the arms to which the keys of the typewriter are attached.

Each arm is notched. Take for illustration the letter "A." You hit the key and the arm depresses the bars below just enough to force the arms of the doll to take the signal position for "A."

The notching, of course, must be done very carefully, so that the arms will move to the proper position for each letter.

Copyright International Film Service

He signed a contract to play caveman in the movies, and later decided to shave; but the law would not let him

The Law Will Not Let Him Shave

IF you never got a shave and hair-cut you would look like the man above. You don't want to, and so you shave. He doesn't want to, but he can't shave; the law won't let him.

For years he, Henry Francis Koser, earned a living by playing caveman in the movies. And then he met the girl; she didn't like his beard—he decided to shave it off—the movie director heard of it—he took the case to court. The result? Mr. Koser is forbidden by law to shet his hair until his contract expires.

Something New in Motorcycles

THE average weight of a motorcycle is three or four hundred pounds—not an easy weight to propel by foot, as becomes necessary when the engine stops.

A new motorcycle has been placed in the market which weighs only one hundred and ten pounds, develops a speed of from [illegible] miles an hour, and is said to run one hundred and forty miles on one gallon of gasoline, under ideal conditions. The machine presents several novel structural features. The engine, which is usually placed between the legs of the rider with its weight almost evenly distributed over the two wheels, rests entirely on the rear wheel of this new model. It is placed to the left of the wheel, and to avoid overbalancing the spokes are offset sufficiently to accommodate the engine and to bring its center of gravity in a line with the plane of the wheel.

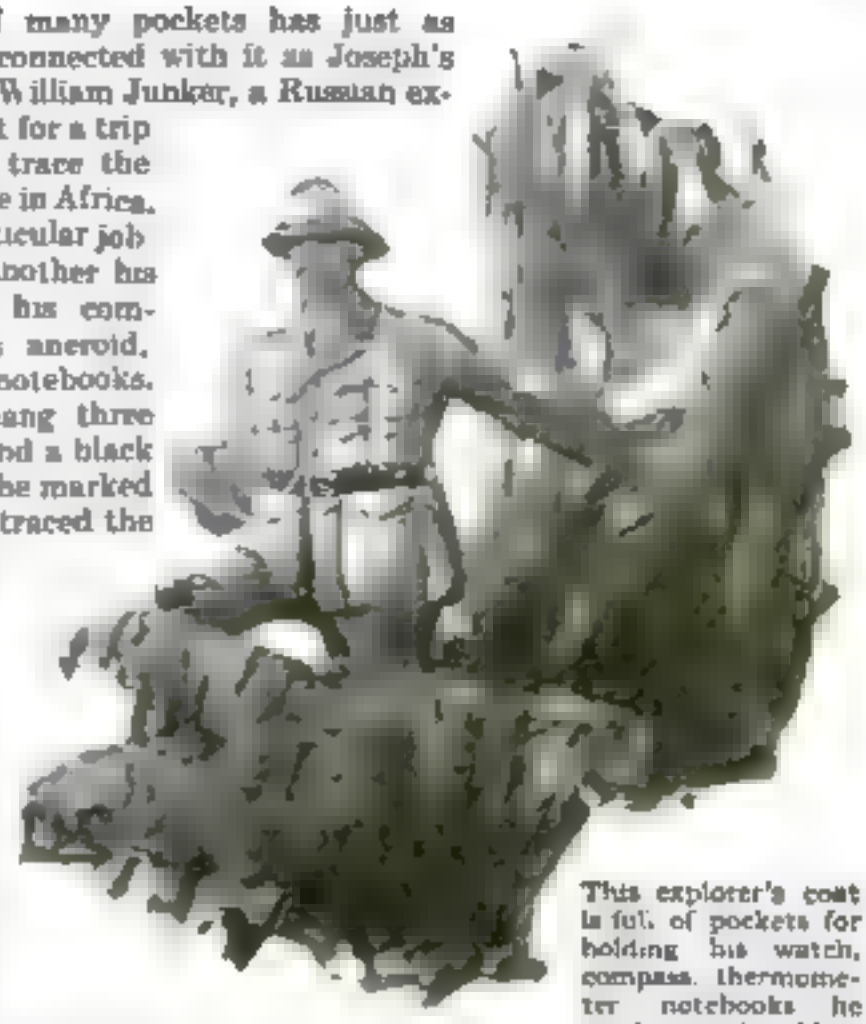
In case of engine trouble, therefore, the rider would have no difficulty in pedaling his machine.

Into the Wilds with Pockets and Pencils

JUNKER'S coat of many pockets has just as interesting a tale connected with it as Joseph's coat of many colors. William Junker, a Russian explorer, designed the coat for a trip in which he tried to trace the course of the River Welle in Africa. Each pocket has its particular job one holds his watch, another his thermometer, another his compass, still another his aneroid, and several more his notebooks.

From one button hang three pencils, a blue, a red, and a black one. With the red one he marked his route, the blue one traced the rivers, and the black one the time of starts and stops.

Mr. Junker wrote down the approximate width, breadth, and direction of course for every river and stream he encountered. Woods, grasslands, deserts, mountains—all of them were noted on the day's map. This careful account of every move was of great service to geographers. He traveled four thousand miles and his average speed was three miles an hour



This explorer's coat is full of pockets for holding his watch, compass, thermometer notebooks he carries a red, a blue, and a black pencil on strings these he uses in making maps

This machine bends the leaf springs to the desired shape and holds them until there is no danger of shrinking and warping

Light weight, easy control, and a drive wheel the grip of which is increased by the weight of the engine are the most striking features of this new model

Making Leaf Springs by Machinery

FOR several hundred years—in fact, ever since the invention of steel—leaf springs have been made by rolling or hammering steel to the form of a band or ribbon of the desired width and thickness, cutting it into the required lengths, bending each piece to the desired form, and finally reheating and tempering it in oil or water to give it the necessary degree of hardness and elasticity.

The hammering frequently [illegible] spots and made its elasticity [illegible] During the heating and tempering process many of the springs became warped. The [illegible]tion of machines for rolling the steel and for holding the springs in shape during the heating and tempering slightly improved the results, but did not eliminate all defects. The first material progress was made recently by the invention of a machine which bends the leaf spring true to shape and holds it while it is immersed in the tempering oil bath until there is no longer any danger of shrinkage or warping

After this operation is completed the tempered leaf spring is released and dropped on a metal conveyer belt which carries it upwards out of the bath to the dryer

This government-owned forging press can be used for research work by anyone who has real experimental work to do

Government Aid in Steel Work

THE extent to which the United States government during the war engaged in experimental and research work in steel rolling and forging problems is probably not fully realized.

The illustration shown a large forging press in the metallurgical department in the building of the Bureau of Standards at Washington which was extensively used during the war by various interests to try out a number of ideas on forging certain alloy, carbon and special steels. The results obtained were of incalculable benefit.

A 16-inch rolling mill was installed in the same department, and both mill and press are still at the disposal of any steel company that may be desirous of working out problems of an experimental or research nature where rolling or forging is involved.

This is a baby toucan; he rests on spiked elbows, waves his claws in the air and cries constantly for food he is a most unattractive creature

What an Ugly Baby!

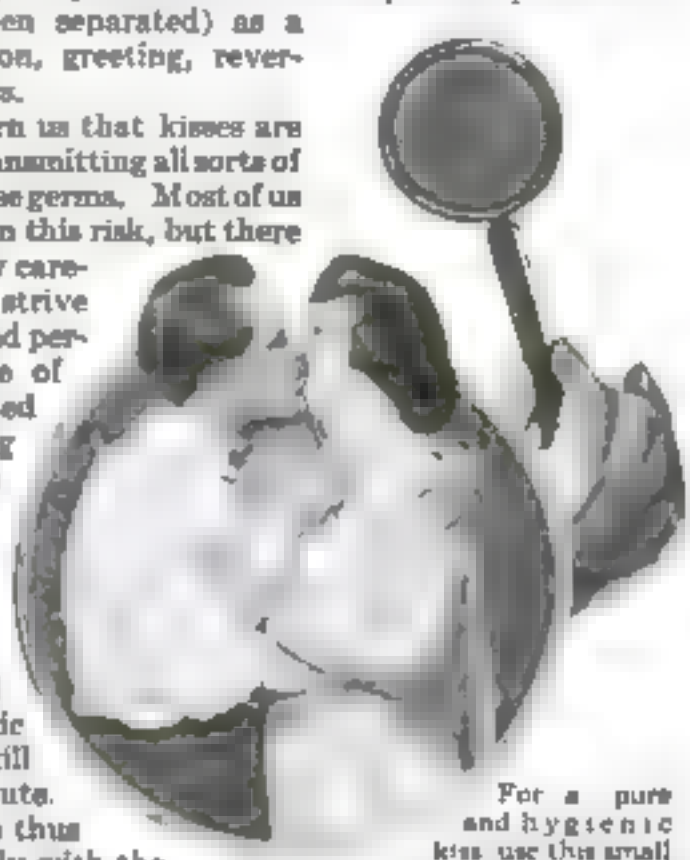
THE toucan is an ugly bird with an enormous beak and a grotesque body. And his new born child is worse Did you ever see anything quite as ugly as the creature in the picture above? It is a baby toucan. He rests on his elbows, which are fortified by spiked pads, waves his claws in the air, and cries all day for food.

Until a few years ago nobody had ever seen a baby toucan or even the egg, nothing was known of the bird's home l fe. It was purely by accident that an explorer happened on a toucan nest in a jungle tree near Bartica, British Guiana. The nest was located in a natura cavity in the tree, about three feet deep. Two white eggs lay on a bed of mold and nuts. The explorer chopped down the tree and kept the eggs. One of them developed into the baby above.

The Pure and Germless Kiss

A KISS, says Webster's Dictionary, is a sweetmeat made of the beaten whites of eggs and sugar, baked; a drop of sealing wax; or pressure with the lips compressed on contact and then separated) as a mark of affection, greeting, reverence, forgiveness.

Scientists warn us that kisses are unhygienic—transmitting all sorts of dangerous disease germs. Most of us are willing to run this risk, but there are always a few careful ones who strive after the pure and perfect kiss. One of them has invented this kissing screen, which might easily be used as a ping-pong racket in its idle moments. The netting is covered with an antiseptic guaranteed to kill all germs en route. But does a kiss thus presented comply with the definition given in Webster?



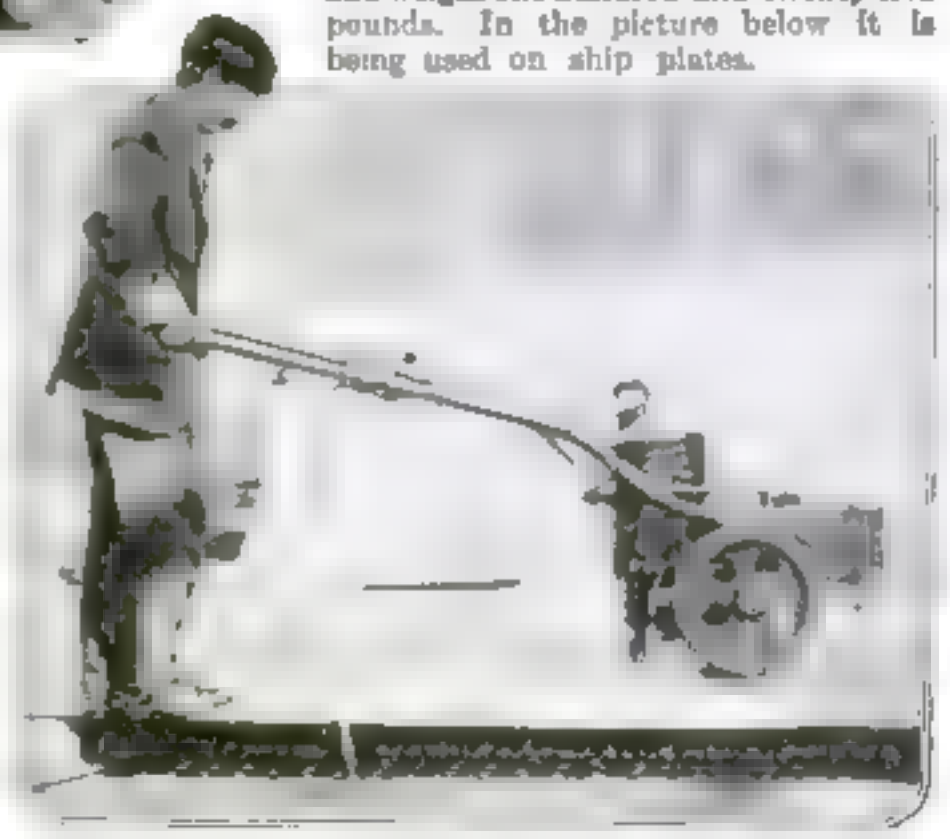
For a pure and hygienic kiss use this small racket after washing it in an antiseptic

Push Your Portable Drill from Hole to Hole

DRILLING holes and wheeling baby carriages become kindred jobs when you use the portable drilling machine shown in the illustration below.

The drill is mounted on wheels and you push it around by means of a pair of long handles. When you come to a spot that needs drilling, you slow up to a stop, turn on the power, and press down on the handles to keep the drill in place. When the hole is finished you move on to the next one, comfortably pushing your drill in front of you.

The drill measures twenty-two inches over all and weighs one hundred and twenty-five pounds. In the picture below it is being used on ship plates.



This drill is mounted on wheels and is pushed from hole to hole by the operator, it works particularly well on ship plates

A Winged Horse in Reel Life

Harry Piel and his horse crash thrills for the German movie fans. Their latest thrill is dropping from a dirigible by parachute from an altitude of eight hundred and fifty feet, here you see Mr. Piel and his bewildered horse just leaving the ground

Ready for the drop. The rider is calm and comfortable, but the horse isn't: he doesn't know what to do with his legs. The parachute is looped over a bar just above the rider's head

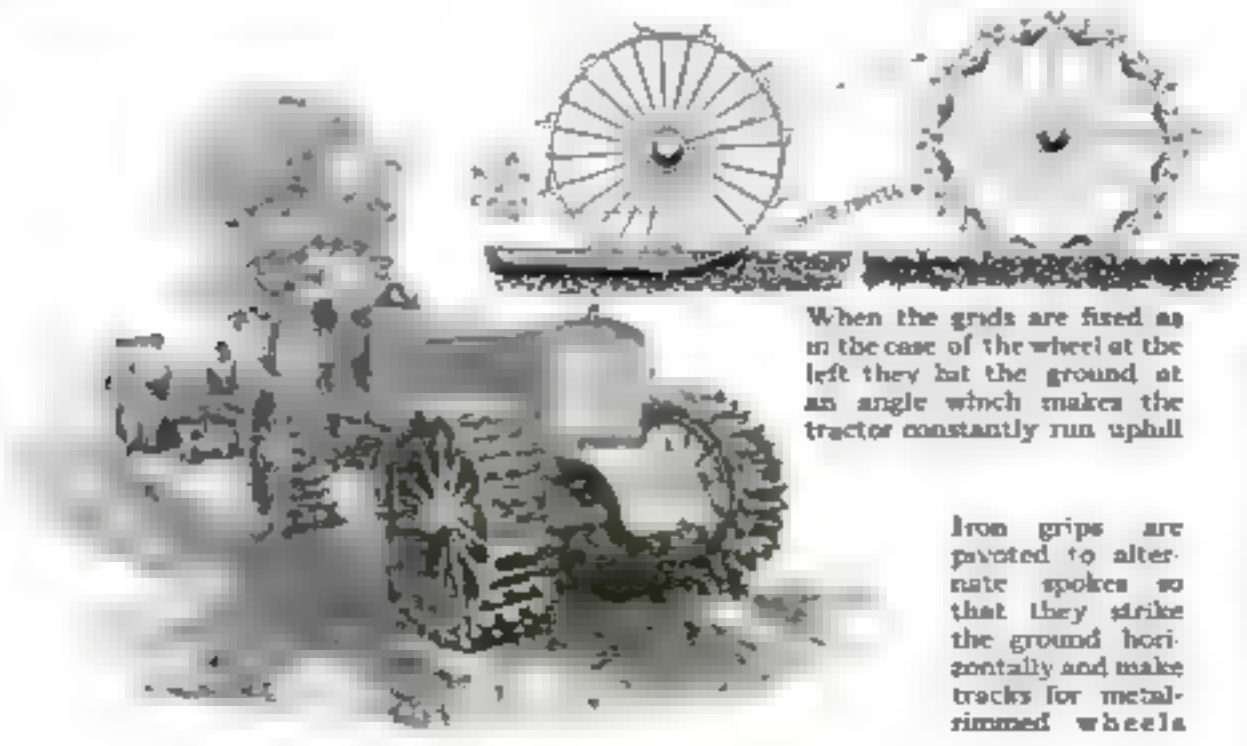
The [illegible] and horse [illegible] the ground and here you see them gently gliding toward earth. The horse, with his eyes glued to the ground is probably swearing that if he lands safely, nothing will ever induce him to fly again

This Wheel Lays Its Own Track

HERE you see the latest thing in the tractor world. It consists of the usual hub, steel spokes, and a rim, upon which, at alternate spokes, are mounted iron grips.

These grips are pivoted so that they are always flat on the ground at the point of contact of the wheel with the ground and thus serve in the place of a metal track.

One of the advantages claimed for this new type of wheel is that the power delivered to the wheel is transmitted horizontally instead of upwards, as is the case in an ordinary steel wheel with fixed rim and cross cleats. In such a wheel the ground is packed directly in front of the wheel and thus the tractor always runs uphill, which wastes power



When the grids are fixed as in the case of the wheel at the left they hit the ground at an angle which makes the tractor constantly run uphill

Iron grips are pivoted to alternate spokes so that they strike the ground horizontally and make tracks for metal-rimmed wheels

Wood that Competes with Steel

WHAT is the hardest wood? If by "hard" you mean enduring, lignum-vitæ, the "vital wood," is at the top of its class.

Lignum-vitæ is the only wood ever discovered that can be used for the bearings at the stern end of the propeller shafts of steamships, and practically every large steamship in the world is dependent upon a block of lignum-vitæ for a smooth running screw.

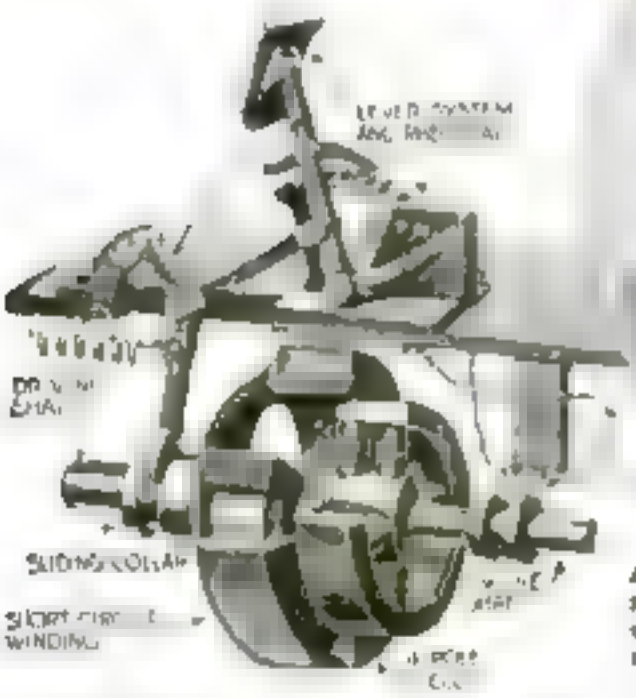
The reason this wood, which is found in the West Indies and in a few other parts of tropic America, is tougher than any other wood is found in the arrangement of the wood fibers. Instead of running up and down, they weave back and forth, crossing and recrossing each other in a manner that resembles the weave of an automobile tire.

Another peculiarity about lignum-vitæ is that when the wood is cut the sap cells fill up with a very heavy resin, causing the wood to weigh approximately eighty pounds a cubic foot. It is therefore about one third heavier than water, and, while excellent for propeller-shaft bearings, would make a mighty poor life-raft.

There's Always Something New

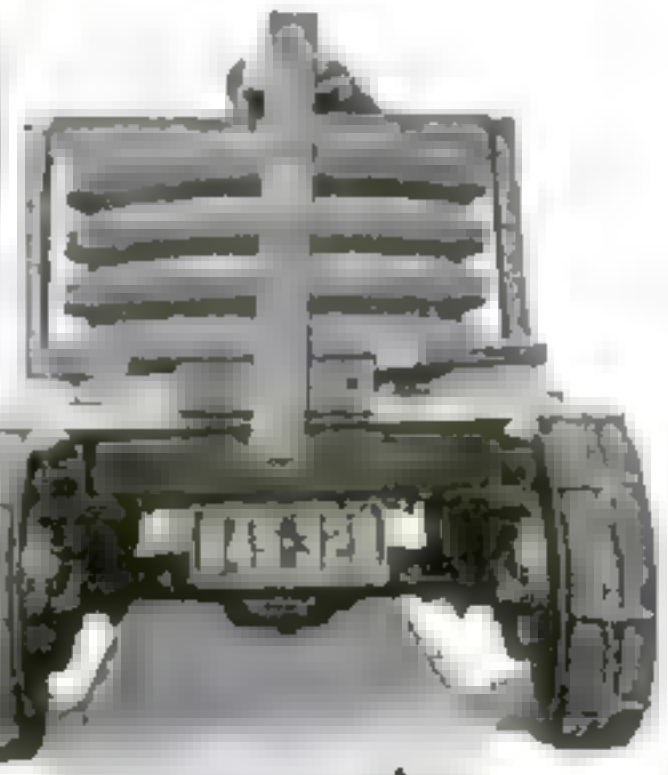
Unless one uses the speedometer shaft lubricator shown above, the grease around the shaft hardens and tends to slow it up or perhaps eventually breaks the gear in the swivel joint. The lubricator forestalls forgetfulness on the part of the car-owner

Used to carry moving-picture reels from one country town to another, this truck serves as an advertiser by using the body sides for huge bill-posters



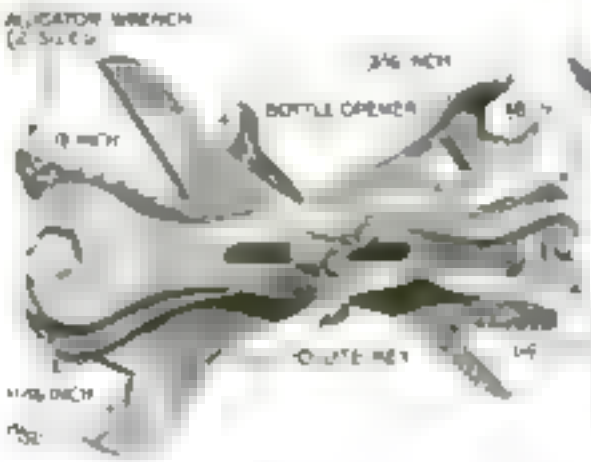
It is claimed that this invention provides a variable speed clutch and control mechanism to replace the friction clutch and variable speed gear used in automobiles

A new motor goggle is hinged at the nose to fit the eyebrows, thus giving comfort, ventilation, and at the same time excluding wind and dust



A skid device for dual or double rear motor truck tires is made of metal cross pieces held by a chain in the groove between the tires

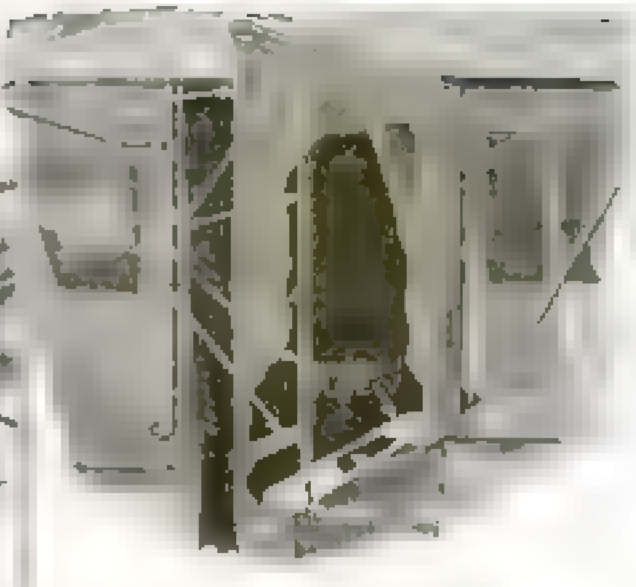
A set of these little bags designed to fit over the Ford operating pedals prevents hot and cold air from entering through the floor-boards of the car



The four-layer automobile wrench fits eight different bolts and nuts, opens bottles, and serves in the capacity of screwdriver when necessary

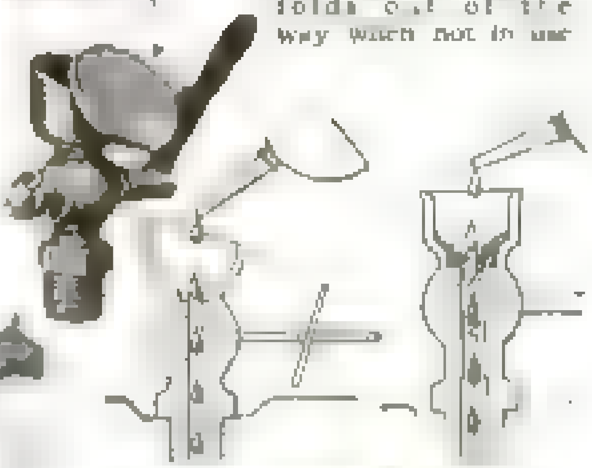
With the smallest automobile engine, this car comes from France. Five years ago it sold for $950, recently it brought $1 500. Eddie Rickenbacker was its old pilot

in Accessories for the Motorist



Acting as an integral part of the [illegible] door a certain attachment offers something long needed by the motorist. It folds out of the way when not in use

When folded and packed the tent with the equipment [illegible] in a [illegible] wheel trailer that can be coupled to a [illegible] car and [illegible] over the highways. It weighs [illegible] pounds and has [illegible] and [illegible] tires

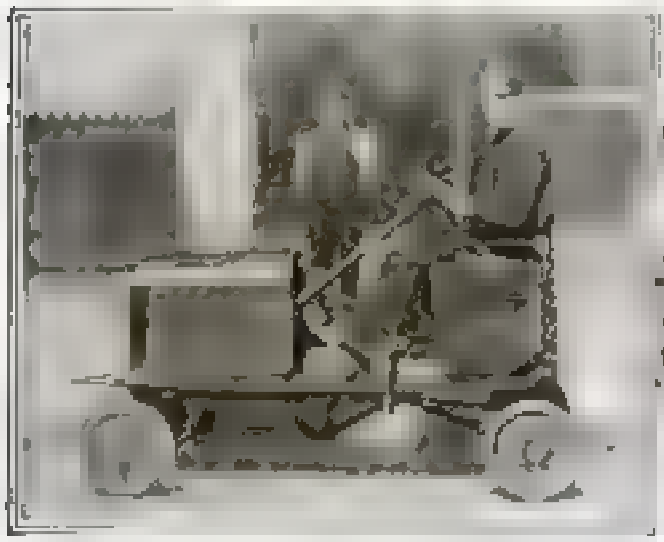


This [illegible] is provided with a [illegible] the bowl. The [illegible] dust and [illegible] the bowl and passing [illegible]

A certain [illegible] in Minnesota [illegible] with a short [illegible] to its [illegible]. The company [illegible] running throughout the winter

A [illegible] gives the necessary [illegible] to permit the car owner to use this [illegible] gun for either grease or oil

A device now upon the market makes [illegible] gas tank whistle when the fuel is low. Its cost is moderate



No, no one stepped upon this Ford. It is built this way purposely to do short hauling in and out of factory buildings. It turns around in a very short radius

The awning frame is made of steel and the covering of waterproof canvas. It comes in different sizes to fit any make of car and its position is easily adjusted

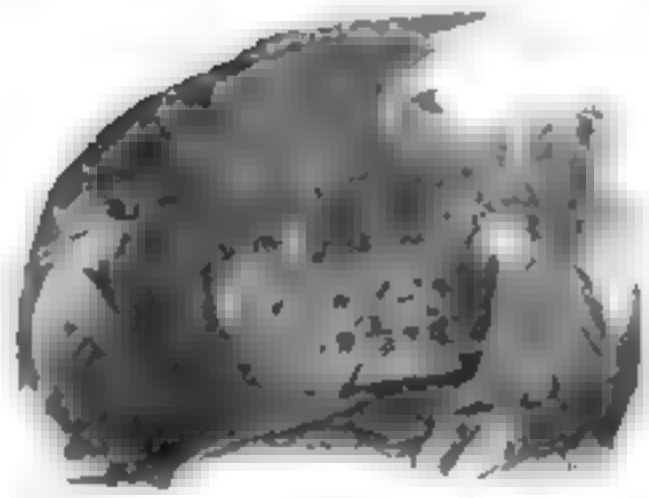
With the advantages of short construction, wheels pivot, enormous leverage, and a high handle that cannot strike the car body, this jack is only forty inches over all

Popular Science Monthly

Using Up the Coal Crumbs

One way of staving off the exhaustion of the coal supply

By Ernest Welleck



With improved machinery like this, even thin veins of inferior coal which formerly received no consideration may be worked profitably, if the coal is used in pulverized form in the boiler plants of industrial establishments

MANY years ago a French writer and philosopher was asked what he considered the most striking difference between human beings and animals. "Animals," was his terse reply, "are always wasteful; human beings only in times of plenty."

The American coal industry furnishes a typical illustration of the truth of this epigram. With almost incredible wastefulness surface outcroppings were first depleted; later the coal underground was attacked. Only the largest and richest veins were worked, while the thinner and less easily accessible veins were neglected and buried under masses of blasted rock.

For many years coal was principally marketed in large blocks. The small sizes, usually mixed with low-grade culm, the tailings of coal mines, were piled up in enormous heaps which were often destroyed by spontaneous ignition. In those days of abundance, when it seemed impossible that the supply could ever become exhausted, nobody even thought of utilizing the low-grade tailings of the mines. Millions of tons were dumped into rivers and lakes or used for filling low ground in place of earth or rock.

The intensive development of our industries after the Civil War created an ever-increasing demand for coal. Coal production developed by leaps and bounds and soon reached enormous figures. It became clear that the available coal deposits were by no means unlimited.

And so, at last, the method of mining coal was improved, making it possible to work even minor veins of inferior coal with profit. But it was not until the increasing cost and scarcity of coal made greater efficiency in its use imperative that effective efforts were made to bring about greater economy in the utilization of coal.

Pulverized Coal as Fuel

Among the most recent of such efforts are the numerous inventions of methods for using pulverized coal as fuel in steam-generating plants. The possibility of accomplishing a considerable saving by the use of pulverized coal in the furnaces of stationary plants and of locomotives has been demonstrated most convincingly by tests which also proved that greater heating efficiency could be obtained by this method.

The economy and reliability of pulverized coal is beyond dispute. This makes it possible to "use up the crumbs" by utilizing the mountains of screenings and tailings accumulated at the mines of the rich coal districts, as well as the low-grade coal, heretofore considered worthless as a fuel, which is found in large deposits scattered over wide areas in different parts of the United States. This coal contains a very low percentage of fixed carbon and volatile heat-producing matter and an extremely high percentage of incombustible mineral matter which forms large clinkers when burned by ordinary methods.

The picture on the opposite page shows the complete installation for burning pulverized coal at the Oneida street power plant of the Milwaukee Electric Railway & Light Company. This plant has been in operation for about two years and has been eminently successful during that period. It was installed without making any change in the settings of the boilers other than a rearrangement of the fireboxes, and gives them a much higher capacity and efficiency than was obtained by the use of stokers. There are several different systems in use, but that illustrated here shows, in a general way, the principles upon which all are based.

The coal, which may be of very low grade, is unloaded from the car directly into a hopper, from which it is fed to the crusher. The crushed coal is carried by a conveyer to the magnetic separator, which removes the stray iron, such as bolts, pieces of tools, horseshoes, etc. contained in the coal. By gravity or other means the coal is next carried to the dryer, where the water contained in the coal, usually representing from five to fifteen per cent of its weight, is removed by heat.

Another conveyer takes the desiccated coal to the storing bins, from which it is conveyed to the pulverizer. By means of a chute the pulverized coal reaches a bin, from which it is fed by a worm-screw feeder, the speed of which can be accurately regulated, to the combustion chamber of the furnace. If the combustion is well regulated and a sufficient draft of air is admitted, no slag or clinkers will be formed. The incombustible mineral parts of the coal will drop in the form of a coarse brown sand into the ash-bin below, from which they are removed from time to time. The ash contains only about two one hundredths of one per cent of combustible matter as compared with thirty to forty per cent in the ash from other furnaces.

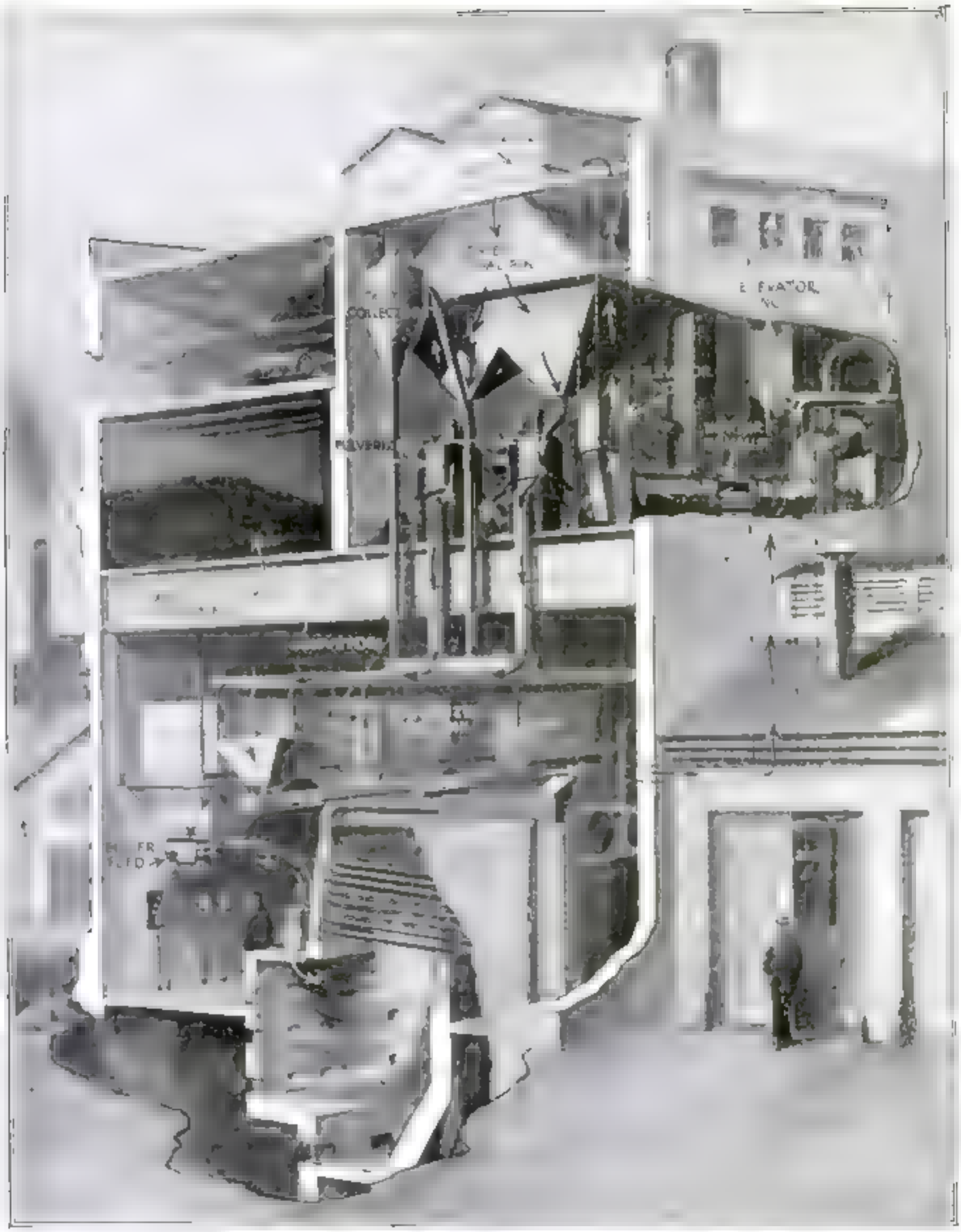
A careful test extending over a period of twenty-four hours was conducted by the engineering staff of the Milwaukee Electric Railway & Light Company some time ago, and gave highly satisfactory results. Coal known as Illinois and Indiana screenings was used in the test. It contained about ten and five tenths per cent of water, nearly fifty per cent of fixed carbon, about thirty-six per cent of volatile matter, and when dry averaged 12,000 B. T. U. a pound. Combustion was virtually perfect; there was scarcely any smoke, and no carbon monoxide in the escaping gases. The ash residue represented only from thirteen per cent to fourteen and five tenths per cent.

Efficiency Test

The boiler efficiency was eighty-five and twenty-two hundredths per cent, and the net efficiency, after making deductions for the coal used in the dryer and for driving the machinery of the crusher and the pulverizer, was eighty-one per cent, or from one per cent to two per cent higher than had ever been obtained by the use of unpulverized coal and stokers.

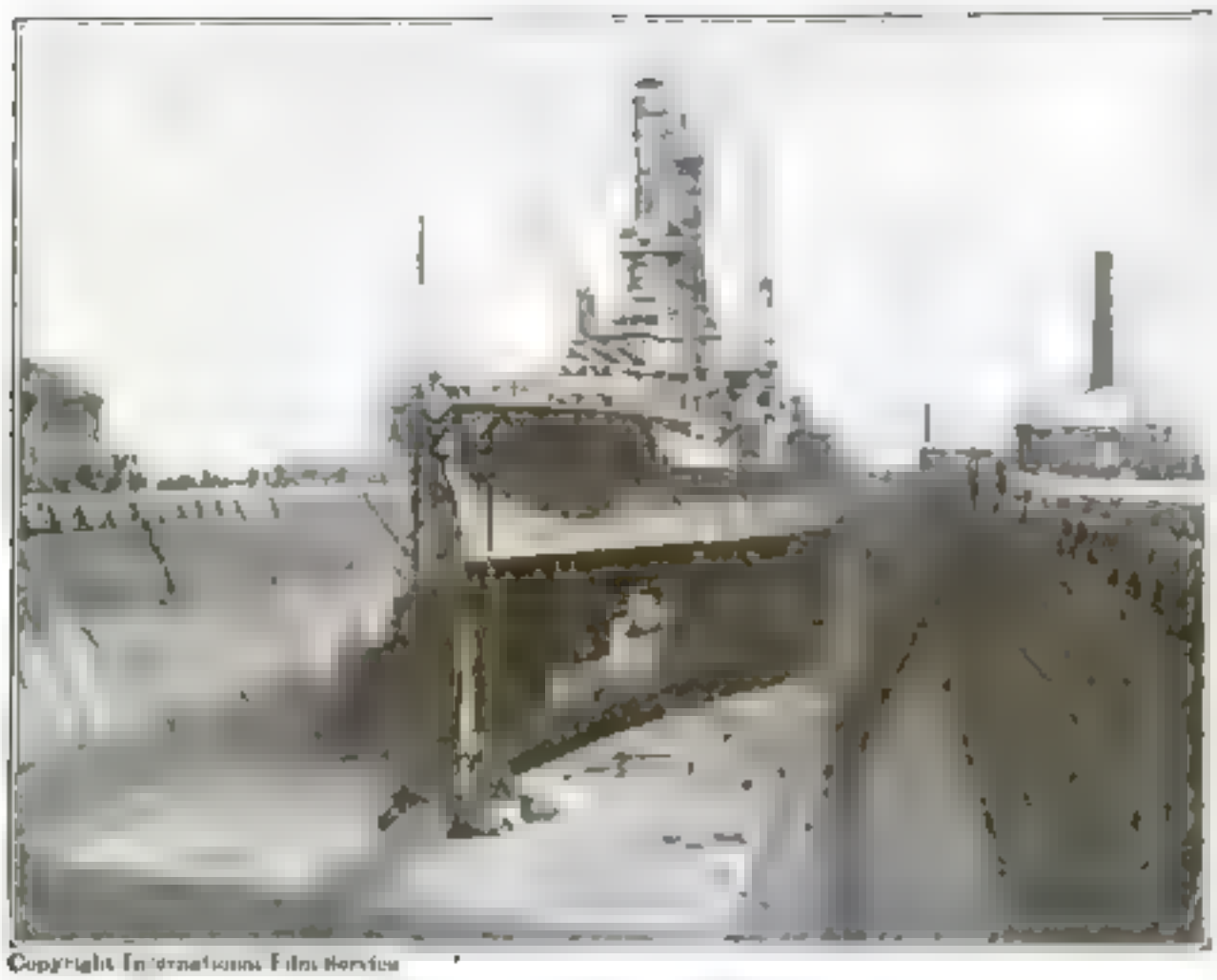
With a consumption of 1,990 pounds of coal an hour an average boiler pressure of one hundred and sixty-seven pounds was maintained during the entire test, equivalent to 546.2 horsepower. During the twenty-four hours a total of 47,775 pounds of fuel was used for changing 393,168 pounds of water to steam. According to these figures one pound of fuel was required to evaporate nine and forty-seven one hundredths pounds of water.

Tests like that referred to, and the experience gathered by careful observations in other plants in which pulverized coal is used, prove conclusively that pulverized coal may be used advantageously in stationary heating plants with a saving of about ten per cent and a possibility of even greater saving in larger plants. The greatest efficiency is obtained with coal so finely pulverized that ninety-five per cent of it will pass through a 100-mesh sieve having 10,000 openings to the square inch.



Showing How the "Crumbs"—Pulverized Coal—May Be Used

This "broken-away" view of the steam-generating plant of the Milwaukee Electric Railway & Light Company illustrates the modern method of using pulverized coal as a fuel. It shows how the coal screenings which are stored in the large bin on the second floor are taken by a conveyer to the tubular drying-chamber thence, having been thoroughly dried, to the magnetic separator on the roof. The separator removes from the coal all particles of iron or steel that may have become mixed with the screenings, to prevent them from breaking the steel cutters of the pulverizer. The cleaned screenings drop into a double bin, from which gravity takes them to the pulverizers which are driven by powerful motors. Between the rollers and cutters of the pulverizers the coal is reduced to a fine, almost impalpable powder, which drops on a conveyer and is taken to a storage bin between the second and the ground floors. The fine dust arising is carried by the draft to the dust collectors whence it is returned to the bin. By a worm feed the pulverized coal is conducted to the combustion chamber of the furnace, and ignited



When a battleship requires a new suit, the fitting-room must be a large one. This is the U. S. S. *Mississippi* in drydock on the Pacific coast

Giving a Battleship a New Suit

THE expression "like a fish out of water" has become, in our everyday speech, a simile for awkwardness and strangeness. It stands for the acme of helplessness. But a dreadnought out of water looks less like a floating fort and more like a ship, as the picture of the U.S.S. *Mississippi* in drydock at Hunter's Point, San Francisco, shows. Notice the graceful, yachtlike lines of her 30,000-ton hull as she lies there. She is the very essence of potential power—and of temporary impotence.

The drydock is known as the No. 2 dock, and has been used for the last year for repairing destroyers. The *Mississippi* is, however, the first battleship to enter it. Some fear was felt at first as to whether she would be able to pass the approaches, but she sailed in without a hitch.

Testing the Resistance of Concrete

THE usefulness of concrete depends principally on the degree to which it resists the crushing effect of pressure, and this, in turn, depends on the quality of the cement, the proportion of the crushed stone, slag, or other material, the proper mixing and "setting," and the proportion and character of the water employed in its making.

The governments of many countries have established bureaus for conducting and standardizing tests to determine the resisting power of concrete.

The picture below shows part of the laboratory of the government testing bureau at Berlin. In the hydraulic press occupying the middle ground and capable of exerting a pressure of four thousand tons on every square inch, a block of concrete is subjected to a crushing test.

The engineer sitting at the table in the foreground is watching the dials for the moment when the concrete block will crumble under the strain.

The resisting power of concrete is tested by a hydraulic press capable of exerting a pressure of four thousand tons to the square inch

Bossie Takes a Chemical Bath

WHEN you have been out in the country in the summertime you have noticed the cows, as they graze, switching their tails and tossing their heads, and sometimes rubbing themselves against trees and fences. Why do they do this? The flies are bothering them, you say, and probably you think that fighting flies is one of the inevitable penalties of being a cow. But it shouldn't be.

There are two kinds of flies that are the principal offenders, the stable-fly and the horn-fly. An important discovery has been made: that the more cows suffer from irritation due to these flies, the less milk they give.

In order to combat the evil, the dairymen, assisted by United States government agricultural experts, have discovered various mixtures that will kill the flies. The mixtures are applied with a spraying-pump. Our picture shows how this is done.

The apparatus, consisting of barrels for the solution and a hand-pump, is carried to the scene of operation in a wagon. The cows are tied to the wheels, and then one man pumps while another directs the spray where it will do the most good. The same spray-pump that is used to kill pests in the orchard may be used again for the cows.

Several mixtures have been found effective, but one of the cheapest and best is the following:

One hundred parts of fish-oil, fifty parts of oil of tar, and one part of crude carbolic acid. Any fly that can stand that has, in our opinion, a perfect right to live.

The peculiar shape of the nozzle on the hose makes it possible to force the disinfectant mixture through the thick hair and against the cow's hide

They Monkeyed with the Buzz-Saw

And now it turns rough logs into finished lumber at the rate of one million feet a day

IT is probable that the first sawmill in the United States was erected at Jamestown in 1607. It was crude, and an improvement mechanically over the then common method, pit-sawing, only in that the work was done by simple machinery instead of, as formerly, by hand. In those first mills, wasteful and slow in operation and of light producing power, there was apparent but little progress toward better methods for very nearly two centuries, when a small circular saw supplanted the old "up-and-down" contrivance that had been in use. This, in turn, retained its place for many years, finally to be supplanted in the manufacture of lumber by the very efficient band-mill of today.

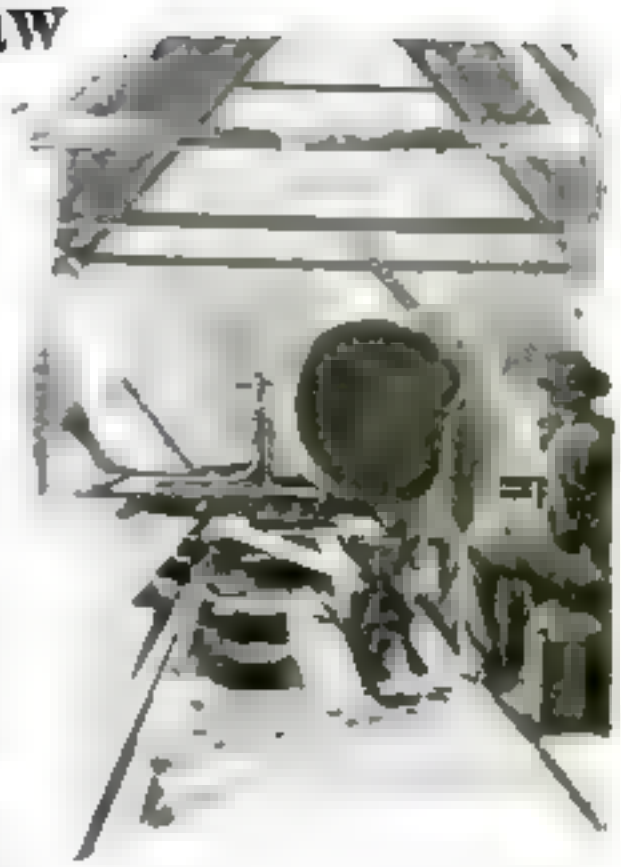
In this field the American was the pioneer, and it is said that his mills, driven by windmill or by water-power, later by the tides on the coast of New England, were cutting the virgin timber of America two hundred years before the running of a mill in England, where the first of them were broken up by mobs of men, loath to see the appearance of any new labor-saving contrivance.

The American sawmill was not always devoted exclusively to sawing timber; for wood was plentiful and ready at hand to those who needed it, and the exigencies of the times very frequently demanded food far more. Many of the earlier milling plants were for that reason a working combination of the saw- and grist-mill; and the miller who received the settler's corn and ground it into meal was also, in many settlements, the sawyer who converted logs into boards.

For many years after the advent of the first circular saws the mills showed few essential changes. Their development, if not entirely arrested, was very slow; old ways continued, as they still continue in certain sections of the country. Then (not more than a generation since) came the band-saw, and with the band-saw greater speed and skill, and a daily cut greater by far than that of which the old sawyers had ever dreamed.

Steam supplanted wind and water-power, to be later succeeded in some large-sized establishments by the electric motor. Crews of two men, the sawyer and his helper, disappeared with their circular saws, their overshot water-wheels and primitive log carriages. The larger timbers of the newer West and South made new demands, and native ingenuity proved equal to modern needs. Small logs and short carriages gave way to huge lengths of timber and carriages designed to travel at locomotive speed.

Though some work is still done by hand, and two or three men "ride the carriage" to fasten the logs in place after high-power machinery has put them there, the first small crews of two men, and sometimes even one, would today hardly suffice for a cut-off saw in the modern mill, with its thirty or forty men assigned to special tasks. The boards are not touched by hand when they leave the log. Endless chains carry them to the trimmers, graders, and loaders, while others carry the scraps and edgings to smaller machines, where they are turned to lath or other by-products.

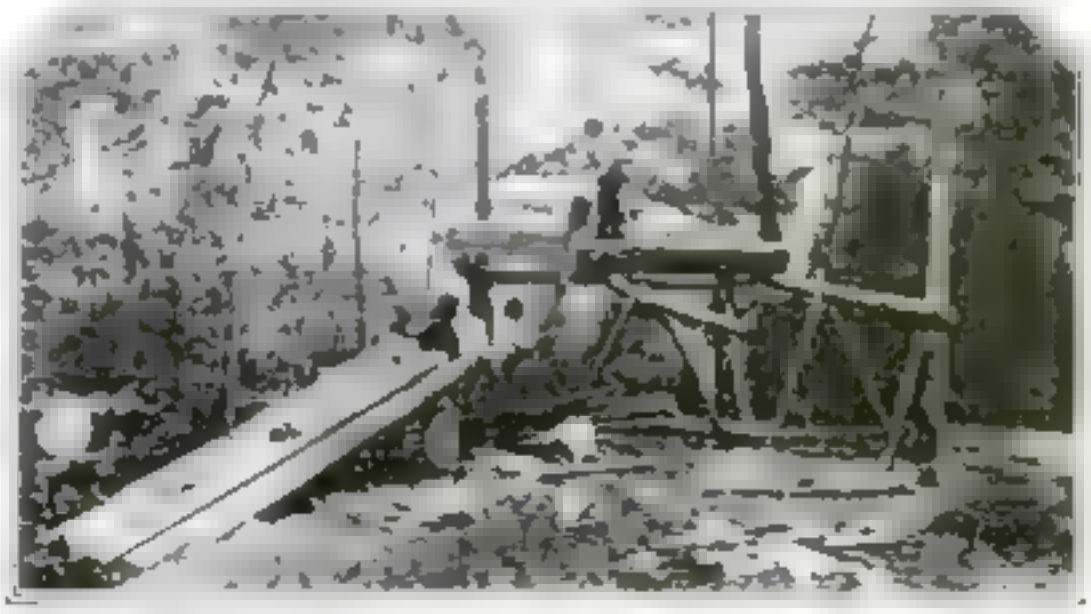


The old-time sawyer found many stiff problems to be solved in the heavy timber of the Southern Appalachians

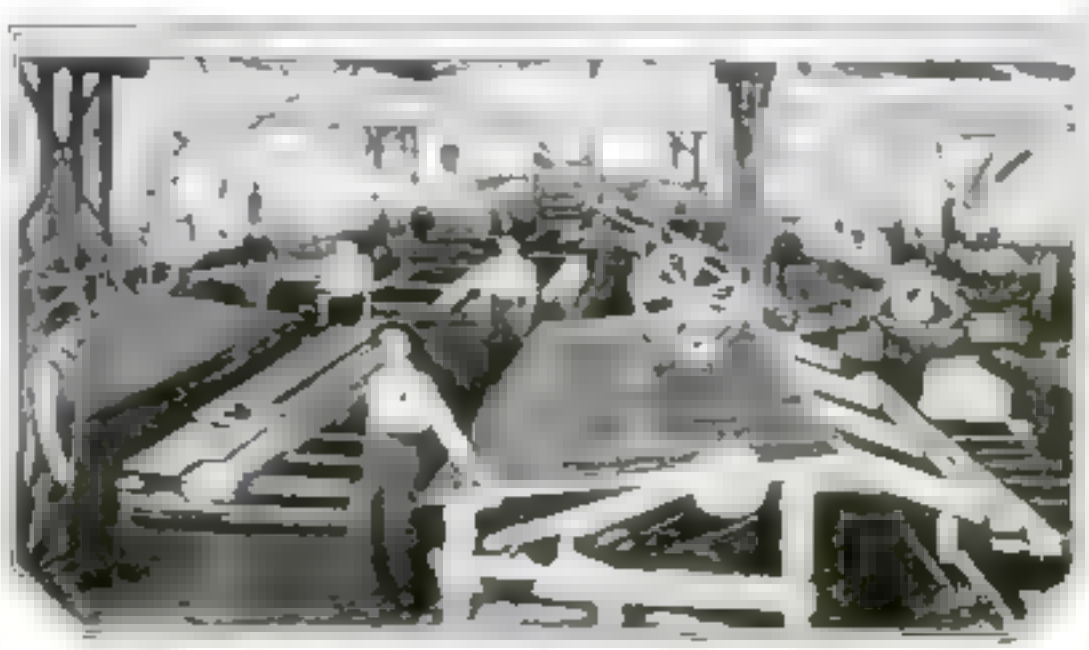
The head sawyer is a high-salaried employee who could throw away his wages in half an hour of careless cutting; for thorough experience, sound judgment, and a quick, trained eye are necessary adjuncts to improved machinery and the increased production it makes possible.

In many of the mills a double-cut saw passes through the log as it goes out and back: the carriage runs forward, a board is cut, the log advanced an inch or two, and another cutting made on its return. Great logs are handled, and disappear, in the twinkling of an eye. The first-class band-mill is a model of efficiency.

A few hundred feet of rough, uneven lumber in a day was the output of the early mill; there are plants in operation in the state of Louisiana that have in excess of a million feet in twenty-four hours for their unit of production.



Methods like these in the hills of Kentucky remind one of days when pit- or whip-sawing was the only *modus operandi*

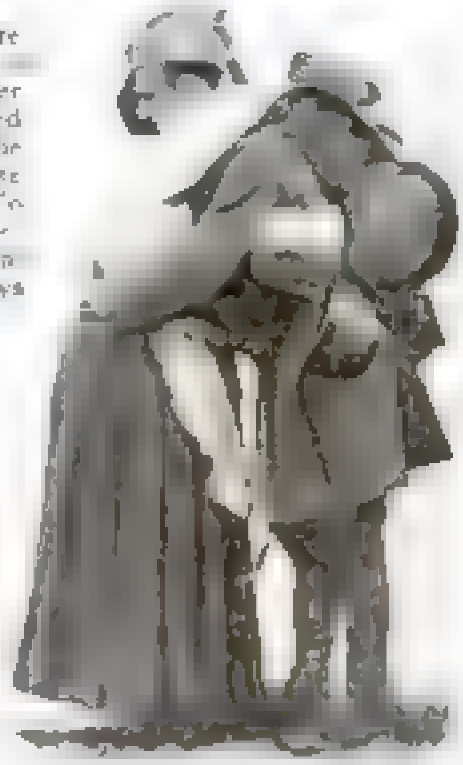


With skilled operators and fast, efficient band-saws, from log to finished boards takes but an instant, and the waste is at a minimum

The Belongings of Soldier Sons Who Died

Phot[illegible]

C[illegible]king up effects is often a heart-rending job. A bag of tobac[illegible] a [illegible] and several p[illegible] his f[illegible] found in one [illegible] bag his address [illegible] his wrist and so [illegible] effects were sent home



M[illegible] mothers were [illegible] to have their [illegible] sons [illegible] returned [illegible] some [illegible] the ultimate [illegible] war. To [illegible] effects of their boys

Here is a typical collection of odds and ends taken from a [illegible] rings, letters [illegible] watch and a [illegible]. These [illegible] the Bureau [illegible]

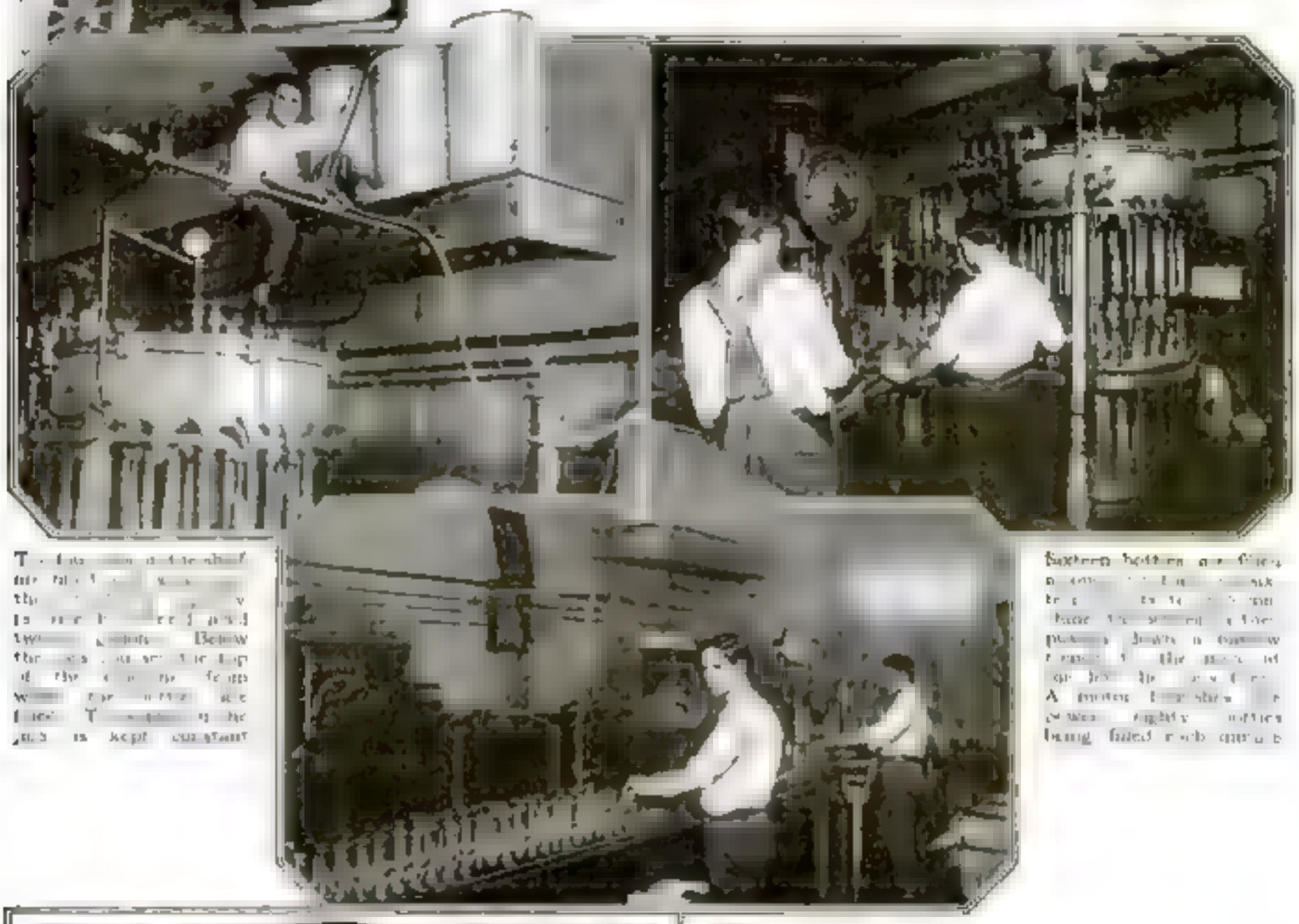
Soldiers and sailors who are [illegible] to the work of opening trunks find it one of the hardest experiences to go through with

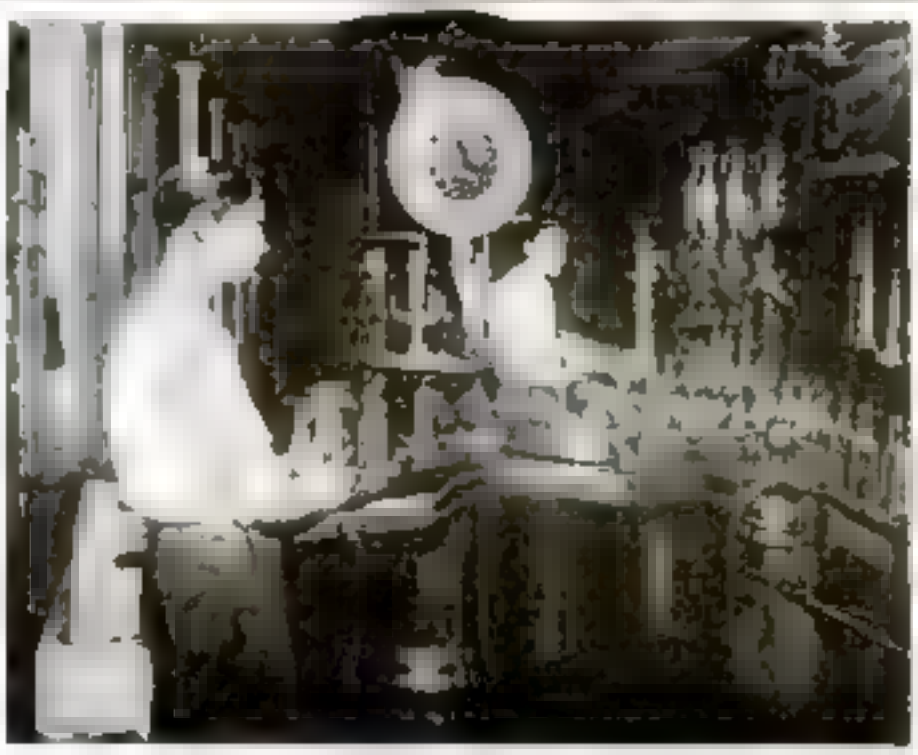
A complete record of every man who was killed is gradually being compiled by the Effects Bureau: here you see several rows of boxes containing the completed records of many of the men

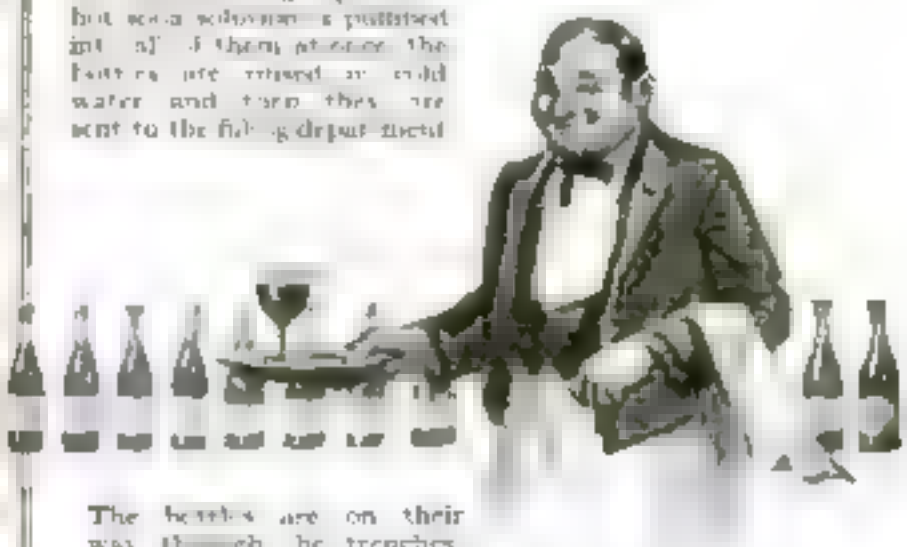
These trunks belonged to soldiers who died in France. The Effects Bureau in New York is trying to locate the families of these men: there are four thousand unidentified trunks stored away in this room

Soda Will Have Its Day!

Here is the way they bottle it and distribute it in Washington







The bottles are on their way through the trenches those in the background are empty these in front have just been filled those up front are being capped in the capping machine and await your order But gentle reader we leave it to you has the waiter the grin that goes with soda?

Each elevator holds seven cars, one above another on inclined floors much like the shelves of a narrow kitchen closet

The Elevator Garage

DID you ever hear of an automobile garage made up of elevators? Well, it's the very last word in garage design, and is likely to revolutionize garage construction in our large cities because it will hold six times the number of cars that can be stored in the same floor area in an ordinary garage building. While the new garage has what is equivalent to seven floors, the car-owner need not leave the main floor to bring his car in, take it out, or have it washed, although the washing is done on a second floor below the main entrance level.

The cross-sectional illustration shows the elevator principle employed. The building is half above ground and half below, and is made up of a series of elevators with a wide aisle between. Each elevator holds seven cars, one above another, on inclined floors much like the shelves of a narrow kitchen closet. Each elevator can be raised high enough to allow the car on the lowest floor, or shelf, to run off on to the main floor, and can be dropped deep enough to permit the topmost car to run off in the same manner. By using forty-two such elevators; two hundred and ninety-four cars can be stored in a garage that would ordinarily store fifty cars. The elevators are of the hydraulic type and are operated from control stations on main floor.

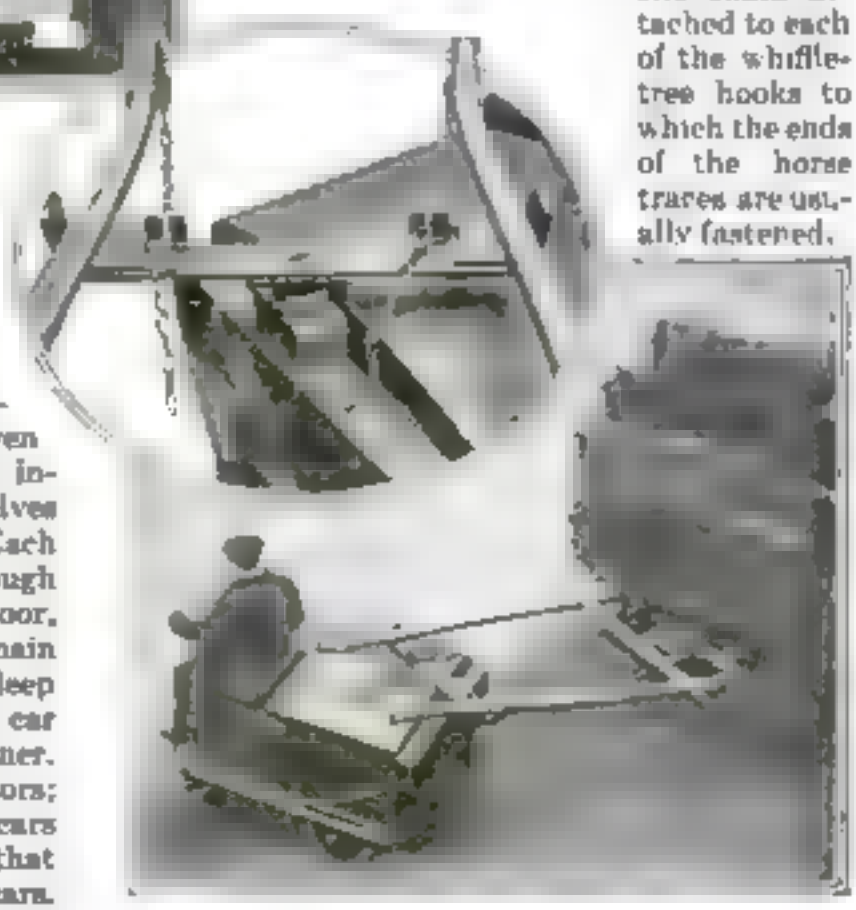
A Special Hitch for Pulling Wagons as Trailers

WHEN horse-wagons are pulled as trailers behind any kind of motor tractor, it is generally necessary to remove the horse shafts and introduce a form of special drawbar. This often requires a change on the wagon which makes it impossible for a horse to pull it again until the shafts are replaced. All this takes time, and so the Chicago manufacturer of an electric industrial tractor devised the interesting hitch shown in the pictures below.

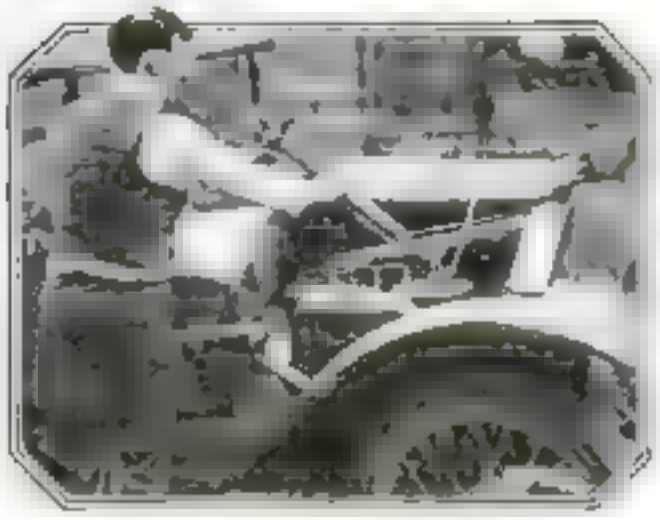
It is not necessary to remove the wagon shafts or make any changes whatever on the wagon. Thus, horses may pull the wagon to a certain point, and after the horses are removed, the tractor may haul it to another point and bring it back empty and all ready to put the horses in the traces.

The hitch consists of a horizontal bar pivoted at its midpoint to the rear end of the tractor. The shafts are placed on top of the bar, and are prevented from sliding off by upturned lugs at both ends and by metal cups placed over the ends of the shafts and chained to two other slotted lugs bolted to the bar nearer its center

One of the vertical links of the chain is inserted through the slot in the lug, while the next or horizontal link contacts with the vertical face of the lug. This makes it possible for the tractor to back the wagon, the pull on the two chains being exerted through the cups to which they are attached to the ends of the shafts. The forward pull of the tractor is taken through one chain attached to the center of the tractor at the rear and divided into two chains at its own rear end, with one chain attached to each of the whiffletree hooks to which the ends of the horse traces are usually fastened.



Remove Dobbin from the shafts and hitch your tractor to the wagon in his place. The special hitch eliminates removal of the wagon shafts



Detecting automobile engine ailments before they develop is the business of this new engine tester

Eliminate Guesswork in Engine Testing

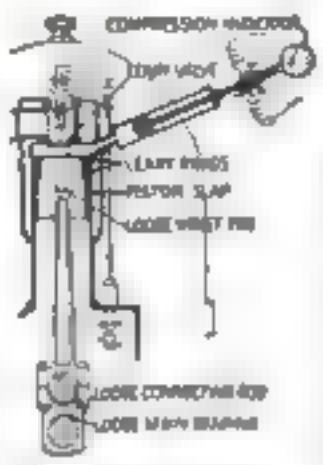
WHEN trouble develops in the average automobile engine, it may be due to many different ailments, the most common of which are leaky piston rings, improperly acting valves, loose bearings, piston slap, etc

Any or all of these troubles can be very quickly located by a new motor tester which looks somewhat like the ordinary tire-pump.

This tester consists of a small metal cylinder with a piston inside. The piston-rod extends out through the top, and is provided with a cross-bar for both hands of the operator. The rod is hollow and has an air-gage at the outside end above the cross-handle. The device is attached to the spark-plug openings.

To test valves, they are first closed and then the tester handle pushed down. A leaky valve will allow the air to blow out through the carburetor or through the intake manifold to the cylinder that is on the suction stroke

This principle of testing an idle engine is new, but it is said to give good results in every instance.



All the spark plugs are removed and the tester screwed into each opening

A Portable Crane for the Garageman

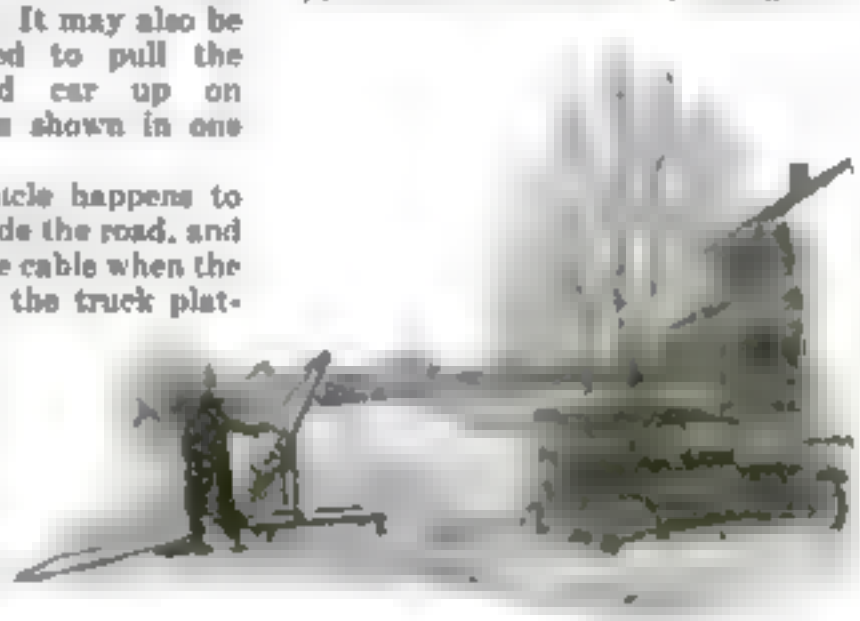
EVERY garageman who has much lifting to do or many wrecking jobs to handle will be interested in the new type of crane shown in the accompanying illustrations. The apparatus is really half a dozen tools combined and its uses are almost limitless. For instance, inside of the garage it may be used for every conceivable kind of lifting work. Being mounted on rollers, it may be moved from point to point without difficulty

Outside the garage it has just as many uses. First of all, it may be bolted to the platform of a motor-truck by removing the base with its rollers. In such a position it may be employed to support the front end of a passenger car or a truck to tow it to the garage. It may also be employed to pull the damaged car up on the truck platform, as shown in one of the pictures.

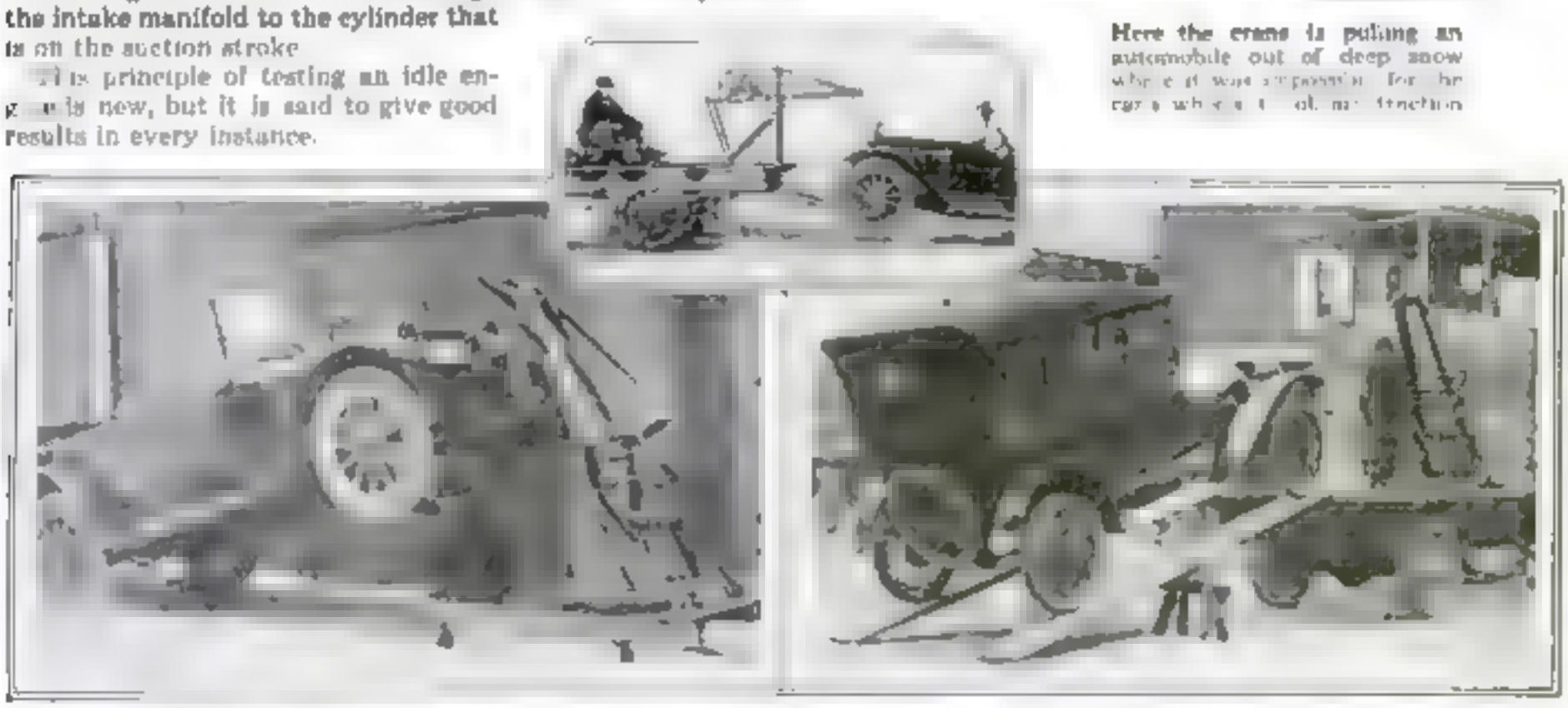
If the damaged vehicle happens to be down in a ditch beside the road, and out of reach of the crane cable when the crane is on the end of the truck platform, the apparatus may be taken off the truck and anchored to the roadway nearer the wreck, so that the latter may be extricated first. Then put back on the truck the crane may be used to put the damaged car upon the truck platform, or to hold its front end if the rear wheels are undamaged so that it may be towed.

All of these uses are made possible by the fact that the apparatus is made in four parts, easily and quickly taken apart, so that, no matter what the task, the equipment may be put in such form as to take care of it. One minute it may be used inside the garage for lifting the front end of a car to make a crankcase repair, and within the next five minutes it may be loaded into the rear seat of a passenger-car or on to the platform of a motor-truck and sent out to succor a damaged passenger-car miles out of town.

Briefly, the four parts consist of the base; the saddle and anchor-piece, the cross-beam, with the complete hoisting mechanism and chain and a crane extension member; and the king-pin. The base consists of two wooden arms mounted on rollers and held together by two crossed pieces of metal. These may be folded to save space when the apparatus is sent out in a passenger-car.



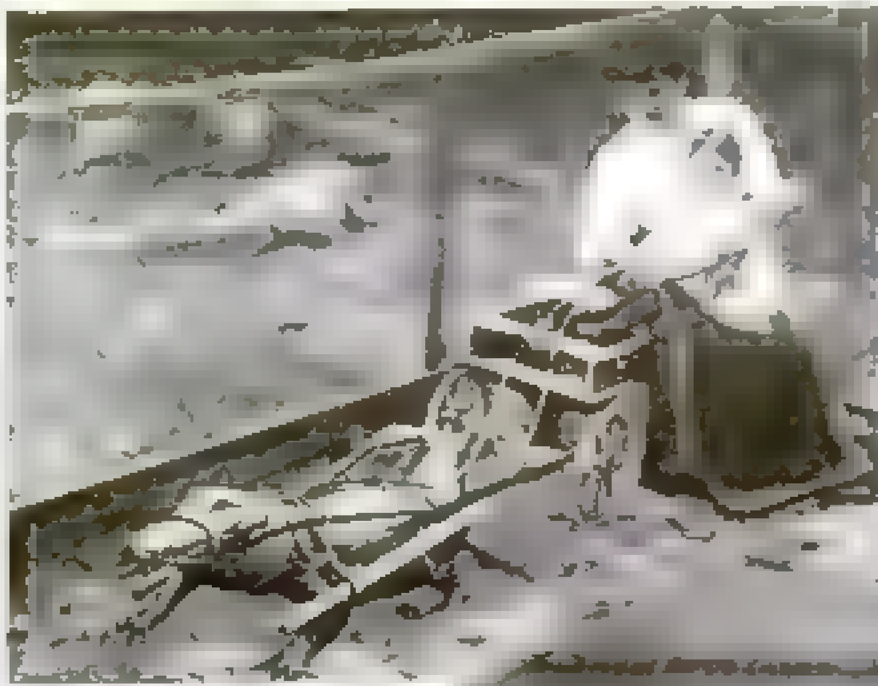
Here the crane is pulling an automobile out of deep snow where it was impossible for the car's wheels to obtain traction



With the car lifted in this manner, it was easy for the mechanic to sit beneath it and repair the injured part

The car above had an accident that damaged its front. The crane was attached to the rear of a truck to pull it clear

A broken drive shaft crippled this car, so the crane hauled it up on a truck to carry it to the garage—a one-man job



Harnessing the Alligator

WHAT'S an alligator good for anyway before he's made [illegible] attractive pocket-books and bags?

Well for one thing, if you muzzle him and hitch him to a small wag[illegible] drag [illegible] you can say [illegible], a part of you.

There are several alligator farms in Florida, and the stunt of harnessing an alligator was first tried there. A picture of an alligator drawing a small girl's cart is shown above.

Because of the size of the alligator's mouth he can't wear a bit and it was quite difficult to teach him to turn around corners.

Oh, What a Shame to Cut It!

JOSEPHUS DANIELS is Secretary of the Navy and he is always being reminded of it. He was asked to a dinner recently, and after he had eaten everything from soup to roast, the dessert was brought on. It was a huge cake battleship with turrets, smokestacks, life-boats and guns all in place. It took the chef a week to make it and he used up a barrel of sugar. Mrs. Daniels received a cake coat of arms made by the same skilful chef. He is shown above smiling at his handiwork.

The See-Saw Arrives in Japan

T[illegible] [illegible]de that the Jap[illegible]ren don't call [illegible] and we [illegible] they don't sing [illegible] Daw while [illegible] up and down but [illegible] themselves just [illegible] as American [illegible]

[illegible] Japanese girl was caught by the camera as she bravely walked on the narrow board that supports the see-saws. You will surely agree that she is brave when you look at her feet: she is obliged to wear her clumsy clogs even during her hours of recreation.

But there's one advantage—clogs are cheaper than shoes and last much longer.

He Peddles Dinners with His Kitchen on a Pole

IN China you will find the dinner peddler; he wanders through the streets carrying his kitchen on his shoulder and shouting "Dinner!" as he goes. You hear him hail him and he serves you a meal on the spot.

This sounds like an ideal plan for eliminating the work of cooking meals, but it has one drawback: you never know when the peddler will show up. In fact, he may not show up at all.

The Face on an Irish-Potato

"WHO put the Irish in potato?" asked Dr. M. Luckiesh of the Nela Research Laboratory of Cleveland, when he came across a potato that had a truly Irish face.

By photographing it in different lights he gave it many characters. Witness the grouchy old man on the left and, on the right, the fighter with one eye completely closed.

Meet the Cattalo, a New American Half-Breed

BUFFALOES are very strong and useful when tamed and many countries are loath to see them die out. Canada has taken to breeding buffaloes with cows—which are plentiful. The result is called a "cattalo." One of them is shown in the picture below.

The experiments in crossing buffaloes with cows are taking place at Wainwright Park which contains a zoo.

She Sells Time for a Living

TIME is valuable, particularly to Miss Belleville of Greenwich, England, since it is her means of livelihood. In fact, she sells it to watchmakers. Every morning she goes to the Greenwich observatory, has her chronometer checked up, and receives a document telling just how many seconds and fractions of a second her chronometer differs from mean time. She then goes to her customers and they adjust their watches accordingly

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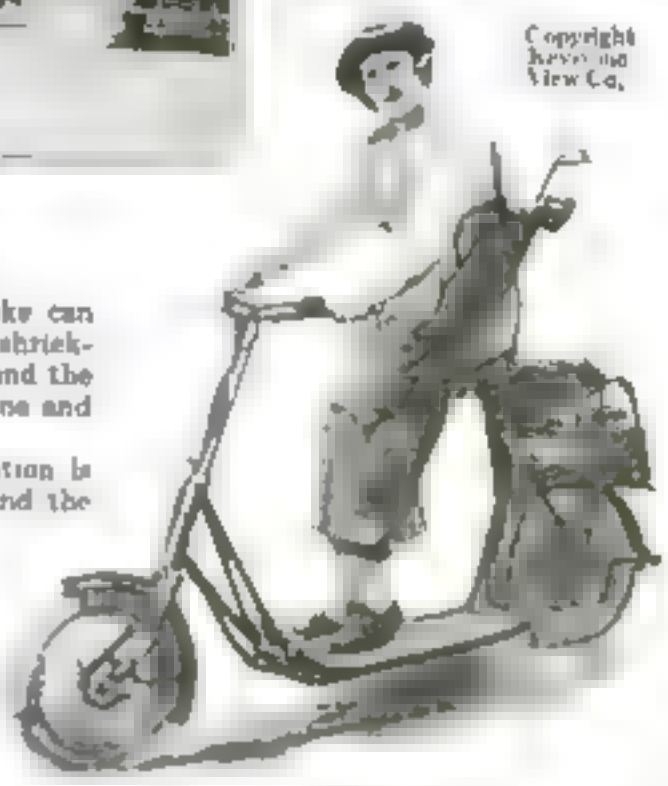
The Speedy Motor Scudder

CHUG, chug, chug! Miss Peggy Kurton, an English society belle, chugs to the golf links on her strange motorcycle. And all her fellow golfers are jealous, for they are unable to get machines like it. Fifteen thousand people have ordered them, but few have been delivered

The machine is easily manipulated and will go one hundred and twenty miles on a gallon of gasoline. It will make a speed of twenty-two miles an hour.



A Fire that Wasn't There

FOR ten blocks a great column of smoke can be seen. With bell clanging and siren shrieking, the fire-fighting apparatus swings around the corner. The men swiftly get out a hose-line and start the stream.

After the smoke dies down, an investigation is made for the purpose of fixing the cause and the damage

To everybody's surprise, no traces of fire can be found. The only untoward thing on the premises is a big patch of grease around the kitchen stove

A kettle of grease had upset on the hot stove top and this had produced a great deal of smoke, but no fire

A One-Boy Tank

CAN a small boy drive a tank, equipped with a gasoline engine and regular accessories? One boy did. The tank was not the famous *Britannia*, however, nor one of its cousins, but a distant relation made to a miniature scale

The little machine was made for advertising purposes by a magneto manufacturing firm. It was an exact replica of one of the great war tanks, with the familiar caterpillar treads

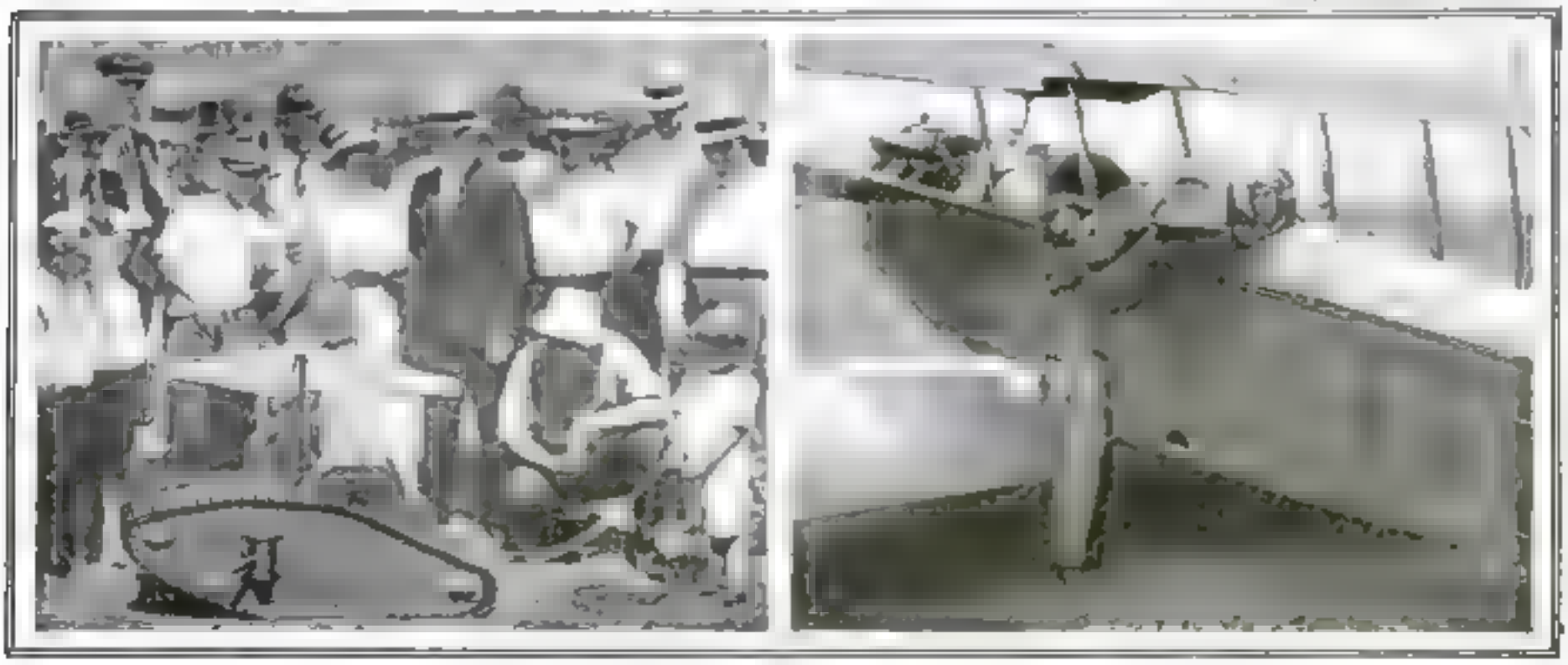
The motive power was furnished by a small gasoline engine, fitted, of course, with the firm's particular brand of magneto.

Music in the Air

THE thought of riding in an airplane fills the general public with great excitement; but the veteran aviator who is constantly flying often finds himself distinctly bored when up in the air. Airplanes are so well made now that there is little chance of adventure.

Below you see two aviators lifting a phonograph into their machine before they start out. Its music will entertain them on their trip. Sometimes, when even the music palls, they try transmitting it by radiotelephone to their friends on the ground

They must have to use an exceptionally loud needle.



Making a Bird of the Airplane

The metamorphosis is accomplished simply by accordion-pleating its wings

By Carl Dienstbach

WERE you ever impressed with the beauty of a large stuffed bird a hawk, for instance—posed in the very act of jumping off into space? Didn't you want to see the thing come to life? But how would you feel if the outspread wings remained "stuffed" and you saw the creature walk, eat, and sleep in that same exaggerated pose?

This little fancy explains perfectly why the eternally "spread-eagled" appearance of an airplane has always grated on sensitive nerves. Nor does the impression change if a purely utilitarian point of view is taken. So far, "stuffed wings" have made life miserable for the airplane—metaphorically speaking—just as for the bird Shunned by automobiles and boats, the awkward contrivance remained banished to rural flying-fields, far from the walk of life. It dared not show its face on streets or roads. To store a single forty- or fifty-foot machine required a building as large and almost as costly as a family mansion.

The Airplane's Awkwardness

Automobiles were eagerly sought by the buying public even in their early days, when they were both costly and dangerous. If the airplane so far has not proved an equally "good mixer," the reason may be explained not so much by expense or danger as by its *awkwardness*. In fact, folding the airplane's wings is a task far more imperative than has been generally realized.

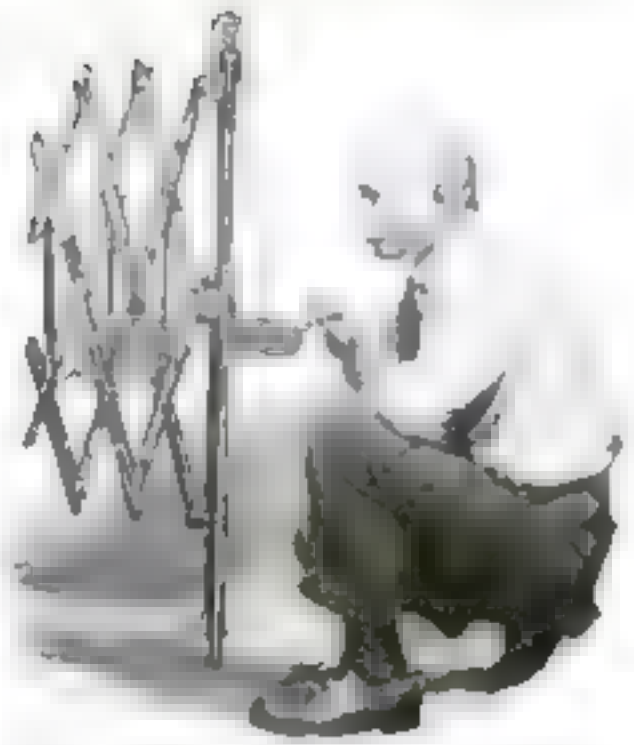
Nature's solution is ideal, but inimitable. Trying to compose artificial wings of sections that like feathers would be capable of "telescoping" over one another, yet having a smooth and strong surface, closed as well as extended, would be adventurous engineering. Swinging rigid wings back, parallel to the fuselage as has been done is only a half measure that still leaves the bulk awkward.

The Folding Wing

But along comes Mr J A. Weis with a plan that is plausible on the face of it, just because it has proved successful in a similar case—the floors of the immense sheds for mammoth dirigibles.

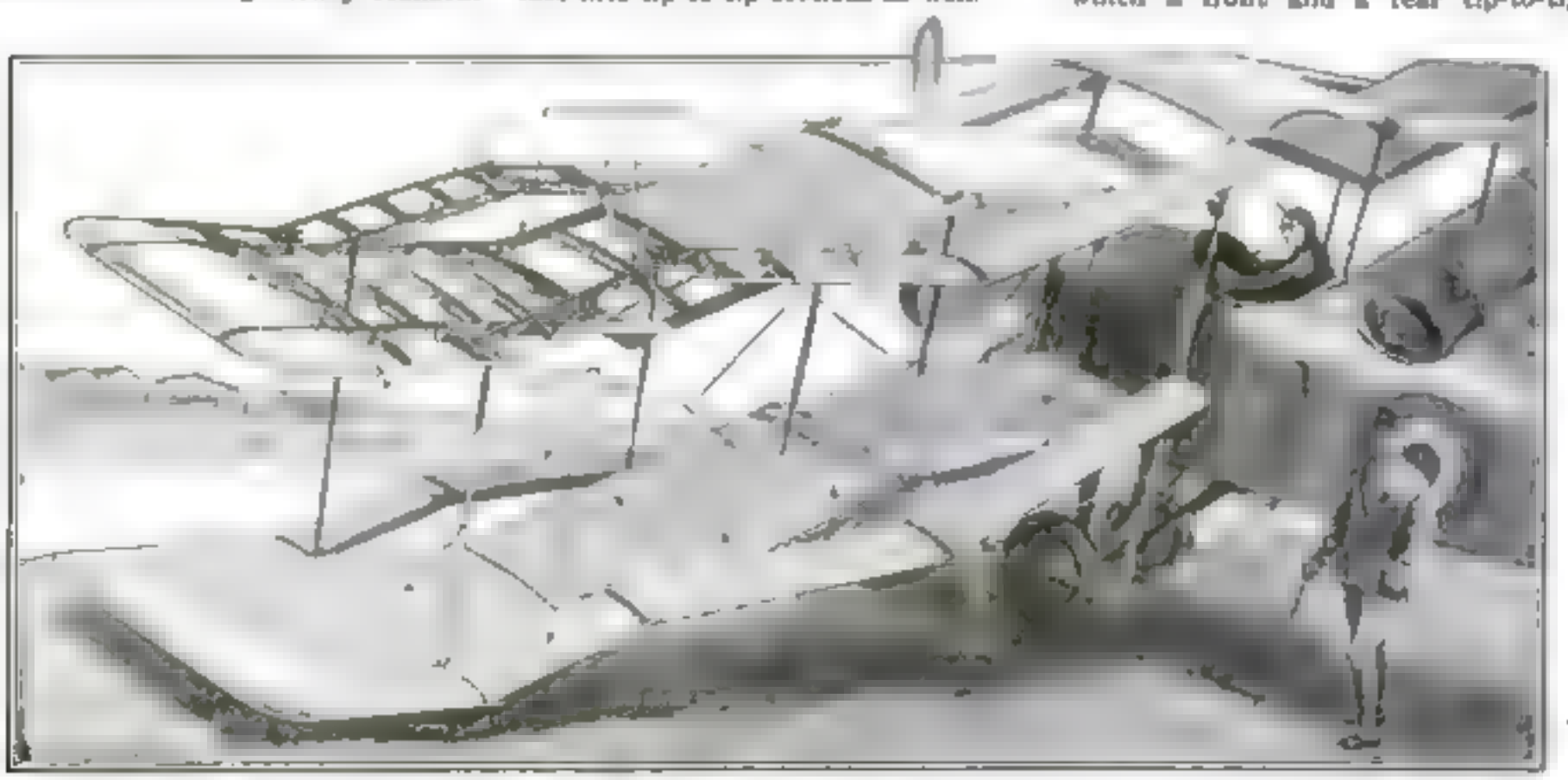
Some architect conceived the plan of snugly folding these tremendously large and massive doors into the towers that flank the shed's entrance, by "accordion-pleating" them. They are composed of parallel vertical segments which fold tightly one against the other, just like the slabs of a fan.

Virtually, Mr. Weis has done the identical trick with the wings of a biplane, by composing each wing of a number of parallel fore-and-aft sections which, folding one against the other, "accordion-pleat" the whole wing. But he had to find a way of performing this folding process from the central "fuselage," and the most natural method was to further dissect the wing's surface into tip-to-tip sections as well.



Can an airplane fold its wings like a bird? Mr Weis thinks so. He is demonstrating the mechanism of his folding wings. Here it is very nearly closed. Pressure on the lever will instantly extend it

Now, he could "break up" one such tip-to-tip section and make of each wing surface a mechanism exactly like the well known "lazy-tong" device. In exactly the same way it could be extended or collapsed by operating one end of it—that next to the fuselage. Pivoting the interplane struts to the center of each principal "accordion section" kept them always upright and parallel to each other. The whole plan automatically made that part of each wing, where oppositely folding sections are joined to form the lazy-tong, the strongest; and, as wings usually possess two strongest tip-to-tip members, the wing spars—a second lazy-tong arrangement, corresponding to the rear spar—were joined to the center section in the rear. So Mr. Weis' whole wing consists of one central tip-to-tip section, against which a front and a rear tip-to-tip



Spreading its wings for flight. The pilot is pulling levers which extend the "lazy-tongs." In a moment the links of the tongs will be parallel, and the wings and supporting spars will be firmly locked into position

section fold in the same opposite sense. This plan has fundamentally the great advantage that it leaves the structure of a collapsible airplane wing essentially the same as that of a non-folding wing, especially as most of the wing structure and all stay-wires except the interplane wires are not disturbed or even affected at all by this sort of folding.

The Strength of the Wing

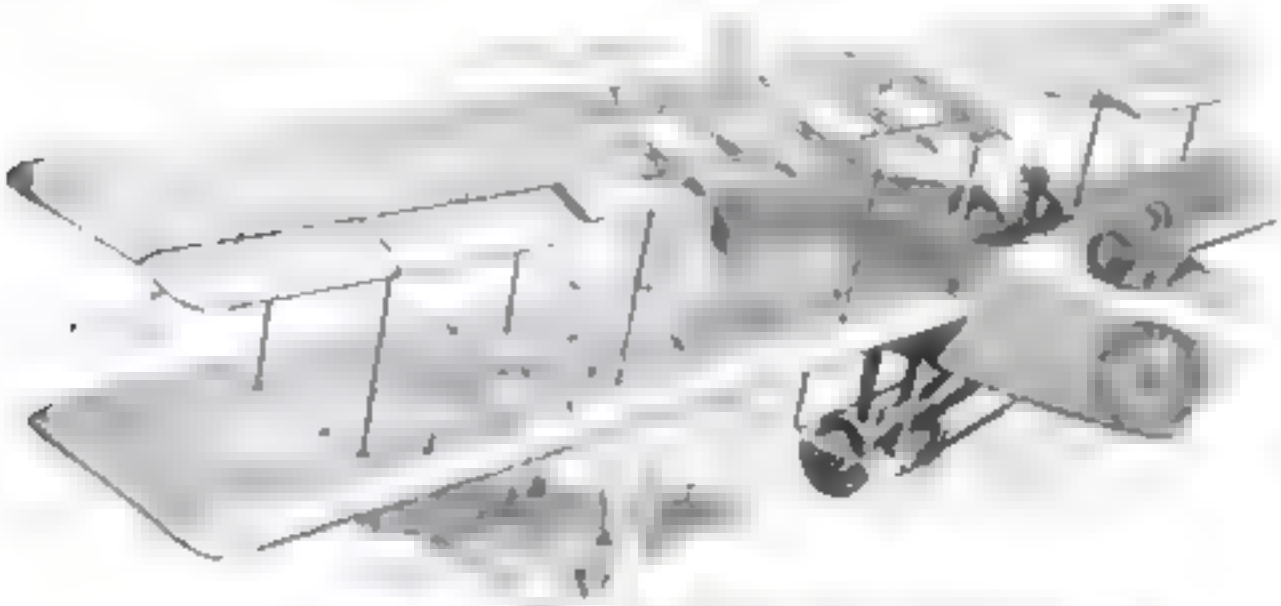
Thus it requires but little added weight to preserve the same degree of structural strength, because, generally speaking, only tensile strength must be compensated for, while compression strains are taken up as readily by "compounded" as by solid parts.

But metal was called for as building material, because perfectly regular shapes of locking edges must be insured, and furthermore only metal permitted the splitting up of parts which were none too bulky in the solid wood. The necessary cutting up of each rib into three separate pieces threw the tensile strains of each rib upon the mentioned substitutes for spars, subjecting them to a torsion which, in turn, required that all the links of the lazy-tongs be fitted as tightly against one another as in a pair of scissors.

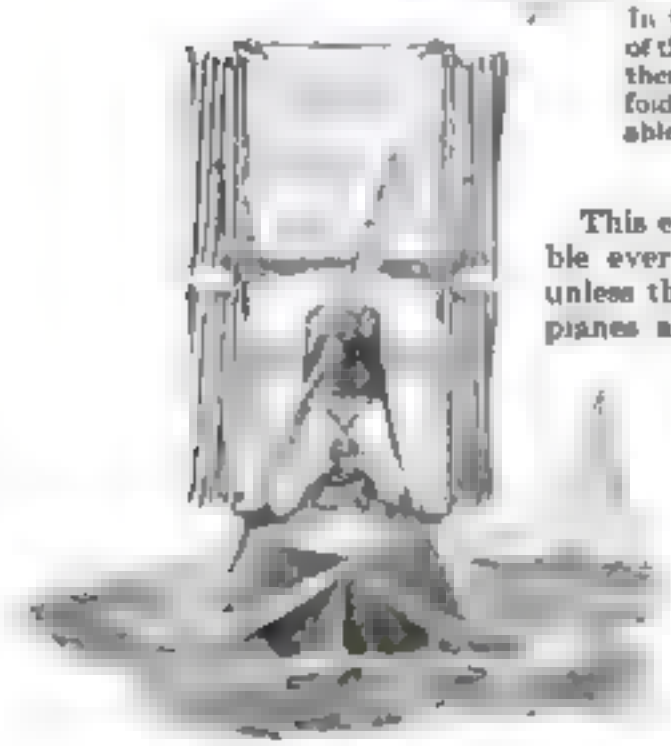
Tensile strength had to be compensated for especially in link-joints of the lazy-tongs that occur just midway between the struts. To spread the wings, these lazy-tongs must be extended until all their links become perfectly parallel with one another. Nothing would prevent opposite links from pivoting eventually in the same sense, and thereby annihilating all compressional resistance of the "spar" they compound. But Mr. Weis has provided an extension to each link beyond its pivot which effectively locks them all against any such motion. As spar strains are mainly compression strains, but little addition of material and weight is needed to lock them securely by this method.

Chief Difficulty of the Scheme

But what is the chief difficulty in Mr. Weis' scheme? I just mentioned it: spar strains are compression strains. Yet a lazy-tong, as even its name implies, is inherently extremely weak against any compression as long as it is yet the least bit folded. Only when it is extended into one perfectly straight line does it become suddenly strong, for the reason that it then ceases to remain a lazy-tong.



In full flight. An extension to each link of the "lazy tongs" beyond its pivot locks them so securely into position that the folding wings become quite as dependable as the more familiar rigid type



Folded close to the body, the flying-boat's wings are no longer an embarrassment when this man-made gull comes to rest or to swim on the water

This explains why it will be impossible ever to spread Mr. Weis' wings, unless the stay-wires between the two planes are so relaxed that they exert none of their usual heavy pull against compression in the spars. It is hopeless to exert the least effort against the pull of these wires while operating the lazy-tong, because—owing to leverage—that would require a prohibitive pressure on the relatively weak handles of the "tong."

Yet the unavoidable tightening of each single wire after the "tong" has been "shot out" is a tedious process that would presuppose it would be done only in a perfect calm, because without stay-wires a wing's strength is *nil* in the wind. Again, imagine the folding of the wings after landing. That is easily done. The wires offer no resistance, but, on the contrary, after the least deviation has occurred from the parallel position of the links, "shoot" the tong in like a catapult.

But what will happen to the wing? Folded the least bit it finds itself without any wire bracing (the wires instantly relaxing). True, folded a great deal, it becomes itself a truss. But how about the intermediate stage? A wing must not be folded before the machine has come to a standstill after landing, because the least air pressure on the wings during folding would prove disastrous.

The following remedy is suggested. All interplane staying should be made of continuous wire cables running over sheaves, just like the warping wires in the old Wright plane. These cables would have to be wound on motor-driven windlasses to take up the slack instantly and with the required force, also permitting "tuning up" stays instantly after spreading the wings. But all this presupposes very nicely perfected mechanical details.

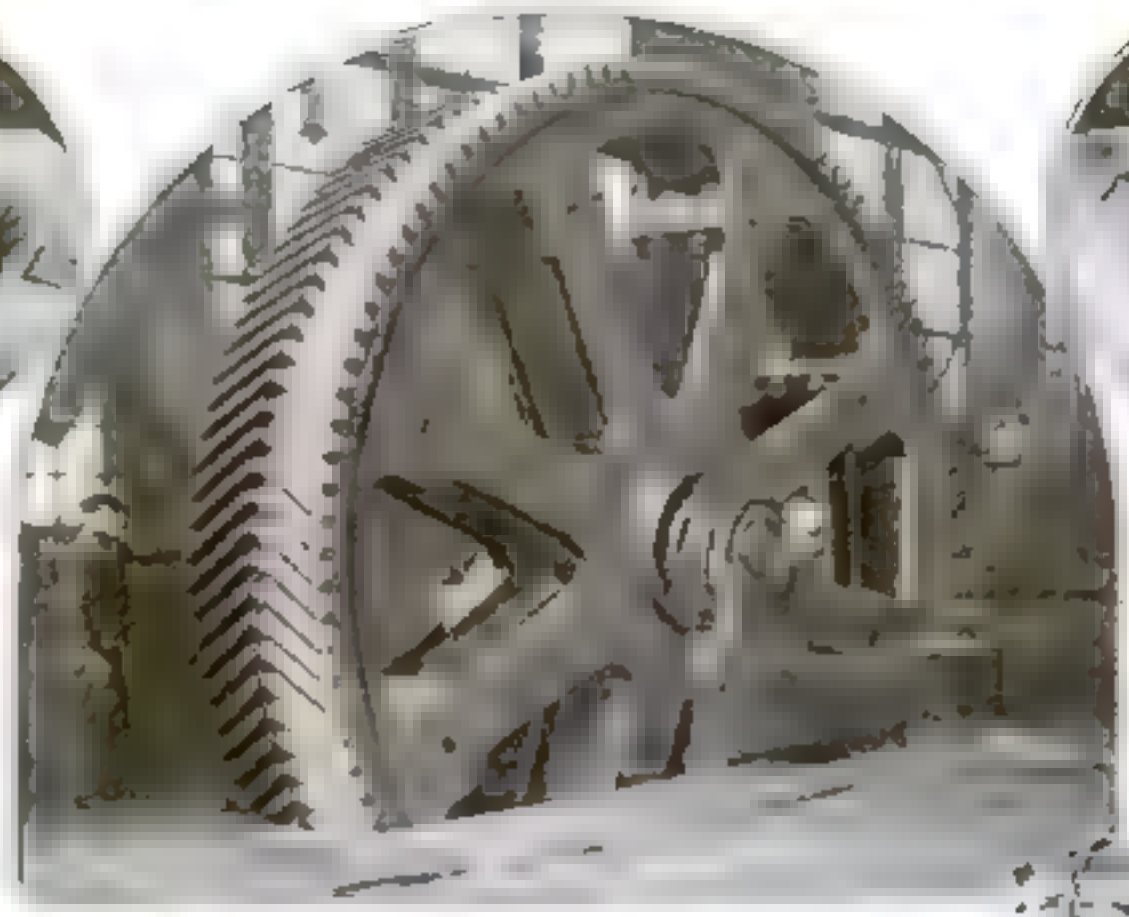
Still, the folding wing is most desirable, for the following reason: hitherto the attempts to stop a machine's headway after landing were liable to result in the machine's jumping again into the air, followed by "pancaking." But with the wings instantly collapsed on touching the ground the tail may be depressed and the wheels braked to any extent. It also may be easily arranged that the shock of striking the ground automatically collapses the wings at exactly the right instant.

It is of importance to mention that experimental regular size wings, constructed for Mr. Weis by the famous *Falcon* airplane works in England, exhibited the same strength and only a fraction more weight than standard conventional wings.

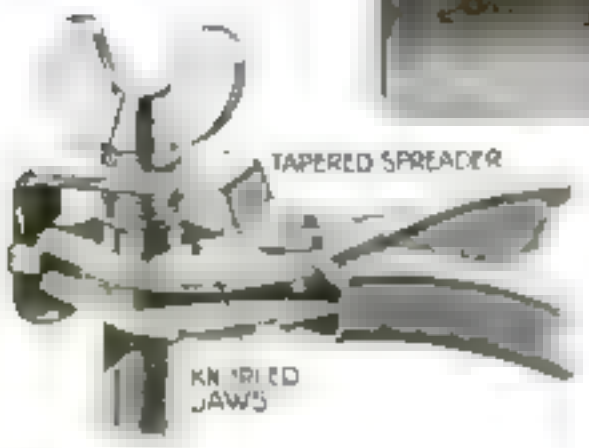
With wings folded the machine can be stored in a garage. When the owner wishes to fly he has only to taxi along the road to a convenient starting-place

Do It with Tools and Machinery

This new device which ties firm knots in threads, leaving the loose ends all very short and of a uniform length, should have a strong appeal to the textile manufacturer



Now comes the saw with an oiler attached to its handle. Simply press down the plunger and obtain enough oil on the fingers to pass over the blade of the saw



Capable of flanging a great variety of tubes, a new tube-clamping arrangement is so designed as to enter and expand the end of a copper or brass tube

The constant flow of oil through this drill is a certainty, for there are no loose tubes to loosen, bend or break away from the main body of the drill

A monster "herring bone" gear weighing 141,210 pounds and capable of transmitting 1,500 horsepower at 40 revolutions a minute. The machine shown cutting the teeth of the gear is said to be the only one of its kind doing work of this magnitude

Grease-cups attached to the connecting-rods of a machine, for example a locomotive, are a decided improvement over the old method of oiling by hand

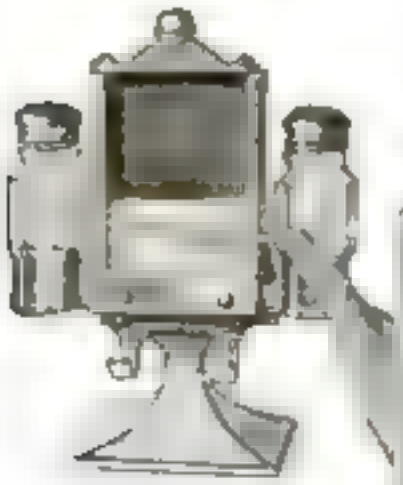
This bit-brace gives the bit various necessary speeds. By releasing one or the other of the upper dogs the high-speed device may be used as a ratchet

It is claimed that the device shown here will clamp all classes of work in almost any conceivable position

A noon-and-overtime rush in a certain factory restaurant deprived many employees of a considerable portion of their lunch period, hence this portable service stand

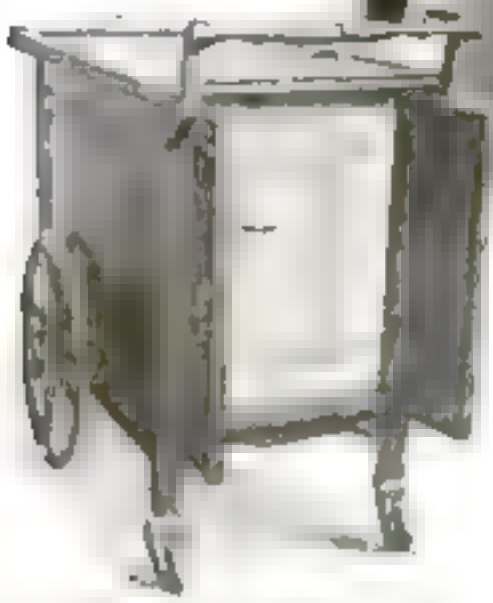
The "dope" for coating airplane wings is placed in a special air-tight can to avoid evaporation of the solvents

Housekeeping Made Easy



Here is a receptacle for keeping toothpicks clean, set in the side of the salt and pepper shakers. Press the little lever at the side, and one toothpick is deposited in your hand

The little thermometer inside your fruit jars tells you whether the cover is air tight or not In case the jar is faulty liquid creeps up the thermometer and you must do it all over again



The refrigerator on wheels serves an admirable purpose in keeping beverages cold until one wants

No more stringy eggs if you use the poaching spoon to lower them into the kettle. The bowl of the spoon is pierced with tiny holes

Ice-cream can be kept in this con tainer for six or seven hours without melting, for the container embodies the same principle as a vacuum

A small hand-operated device to easily place upon the market combines even a child to make the most beautiful and intricate embroidery It is easily carried in a hand-bag

This window-cleaning contrivance makes it possible to clean either the outside or the inside of a window without danger of falling

Soak a porous stone in a pan of kerosene Then place it among the furnace coals and ignite it It starts the fire easily and can be used over and over again

The ballast cleaning machine is built low so that it does not interfere with passing trains. Clean ballast means sound ties

To Keep Ties from Rotting

RAILROAD ties are usually made of wood, and constant attention is necessary to prevent them from rotting. One of the most fruitful causes of trouble is the stone filling or ballast between the rails. Around the ends of the ties, as a result of the constant dropping of dirt and grease from the trains, the ballast becomes mixed with dirt. Gradually it buries the ends of the ties, allowing damp and other disintegrating influences to work havoc.

The old way of combating this was to fork over the ballast by hand. Now a machine does the work in a fraction of the time formerly required

The machine is a miniature chain-and-bucket elevator, run by a gasoline engine. The frame has guides at the sides to keep it in the right position between the tracks. It is moved along by means of a chain-and-ratchet arrangement. The buckets dig up the ballast from the ends of the ties and deposit it on a wire screen. This is mechanically shaken and the dirt is sifted out into a steel pan, the ballast sliding off the end of the screen back on to the track

With this machine a crew of five men can clean about thirty-three feet of rail in forty-five minutes.

Welcome News for the Smoker

SCRATCH, scratch! No light! Scratch, scratch—what's the matter with these matches, anyway?

As a matter of fact, the matches are all right. It's the striking surface on your box that's at fault, and the war is to blame, of course! It caused a shortage in antimony, which is one of the ingredients used in coating safety-match boxes.

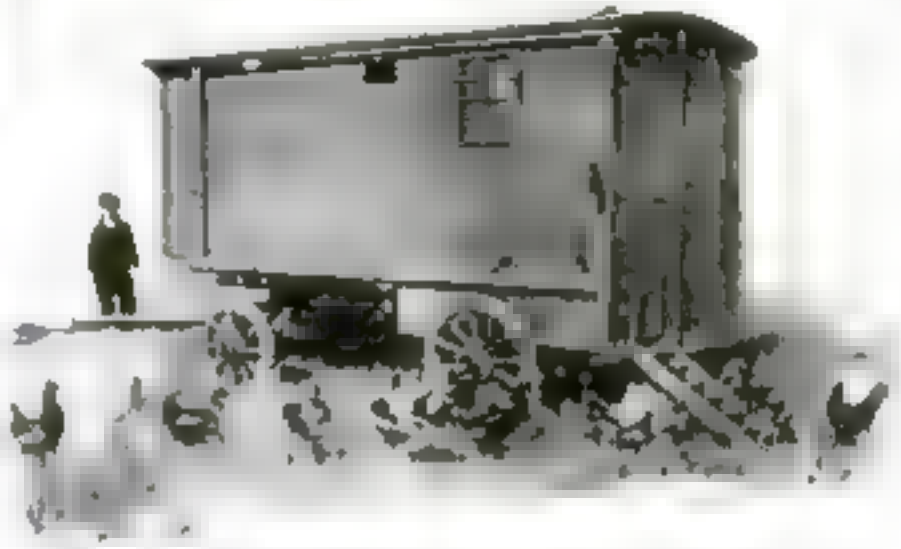
But now a substitute has been discovered. It is called "brilliant friction" and is being manufactured in Slovakia.

Perhaps this sounds indefinite and far away—but already great quantities of the composition have been exported to Sweden, Denmark, Holland, Austria, and Germany.

Keeping Hens on the Move

WHAT exciting lives German hens must lead! Throughout the harvest-time they never know, on going to roost at night, where they will be in the morning. Why? Because they live in traveling hen-houses. Each night, when the hens have turned in, the hen-house is carted to a near-by field from which the grain has recently been harvested. Next morning the door is opened and a ladder attached. The hens hop down and feed all day on the waste grain that was left on the ground.

This method of feeding chickens is both simple and cheap; and the chickens greatly approve of it, since they can eat all day long.



Instead of taking feed to the chickens, the Germans take their chickens to the feed, the hen-house is wheeled to fields from which the grain has recently been harvested

Dial Indicates Inaccuracy in Lathe

TRUING of work in a lathe and finding out whether the centers of the lathe are in alinement is made easy and certain by a new indicator-gage.

The gage is simplicity itself. It has only four parts, which are a Z-shaped rod, a long pointer, a plate carrying an indicating scale, and a small metallic body having on one side a recess to receive the dead center of the lathe and on the other side a centering point adapted to enter the center recess in the work

The work is placed in the chuck of the lathe, and the truing-gage is inserted between the work and the dead center. The lathe is then started up, slowly.

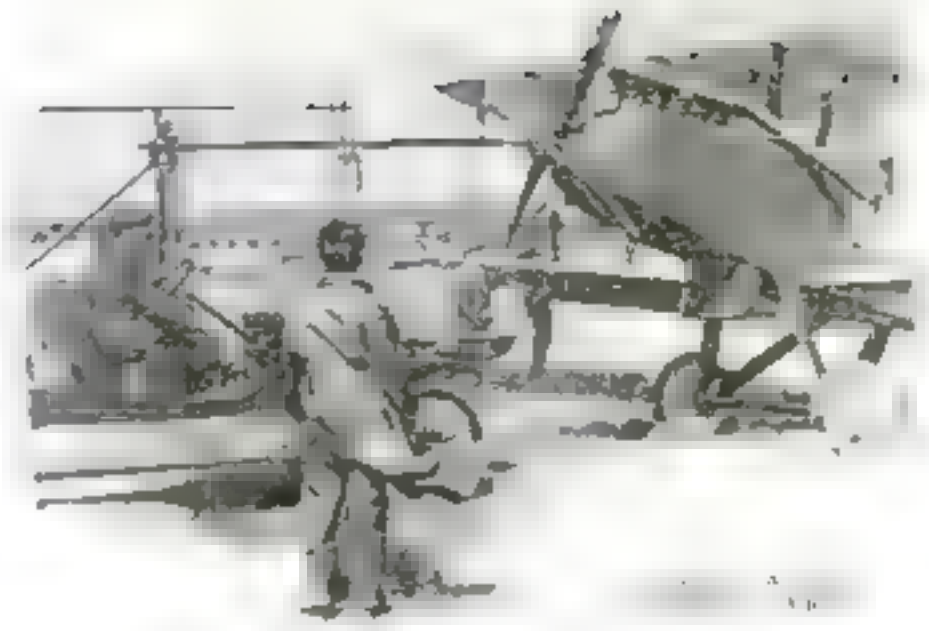
If the work is set up true the indicator will remain stationary, but if there is the least inaccuracy it will cause an eccentric movement which is magnified down the length of the indicator-rod. This magnified eccentric movement is plainly discernible and the exact extent of the inaccuracy is indicated on the scale.

The use of the gage is not limited to the truing up of the center mark of work to be bored, but it may also be used for testing the truth of the center of a lathe spindle, for truing up the face of work, and for setting the tailstock in accurate alinement with the headstock.

In the illustration the scale is supported by an ordinary machinist's surface gage, but, as shown at the right, the scale may be clamped to a stationary part of the lathe

Cranking the Airplane

It is an awkward moment that science has heretofore neglected



An automobile motor is connected by a chain drive with a shaft that terminates in the propeller hub, when the motor is started the propeller turns over

"HOW like a bird!" you murmur soulfully as you watch an airplane glide swiftly through the air. But if you saw the ugly, mechanical way in which its motor was started back there on the field, you'd change your tune to "How like a flivver!" For the airplane's motor is cranked; and this cranking is no easy flivverish job either, since the dangerous sharp-edged propeller is right on the spot all the time.

How is it cranked? One clumsy method is shown in the picture at the top of the page. An automobile motor is released from driving the wheels and is connected by a chain drive with a shaft that terminates in the propeller hub. When the motor of the automobile turns over so does the propeller.

Even this clumsy method is a distinct improvement over the earlier one in which the propeller was turned by hand. That was so "mechanically indecent"!

The pilot and passenger were, in a way, as passive as children in a baby carriage; it was the "gang" that "shoved them into space"—the crowd of mechanics that first took hold of the [illegible] both wings, and especially that daring mechanic who started the motor by tackling the deadly propeller [illegible] he could, [illegible] he sharp blade gave it a twist, and jumped back in time to save himself from being chopped up.

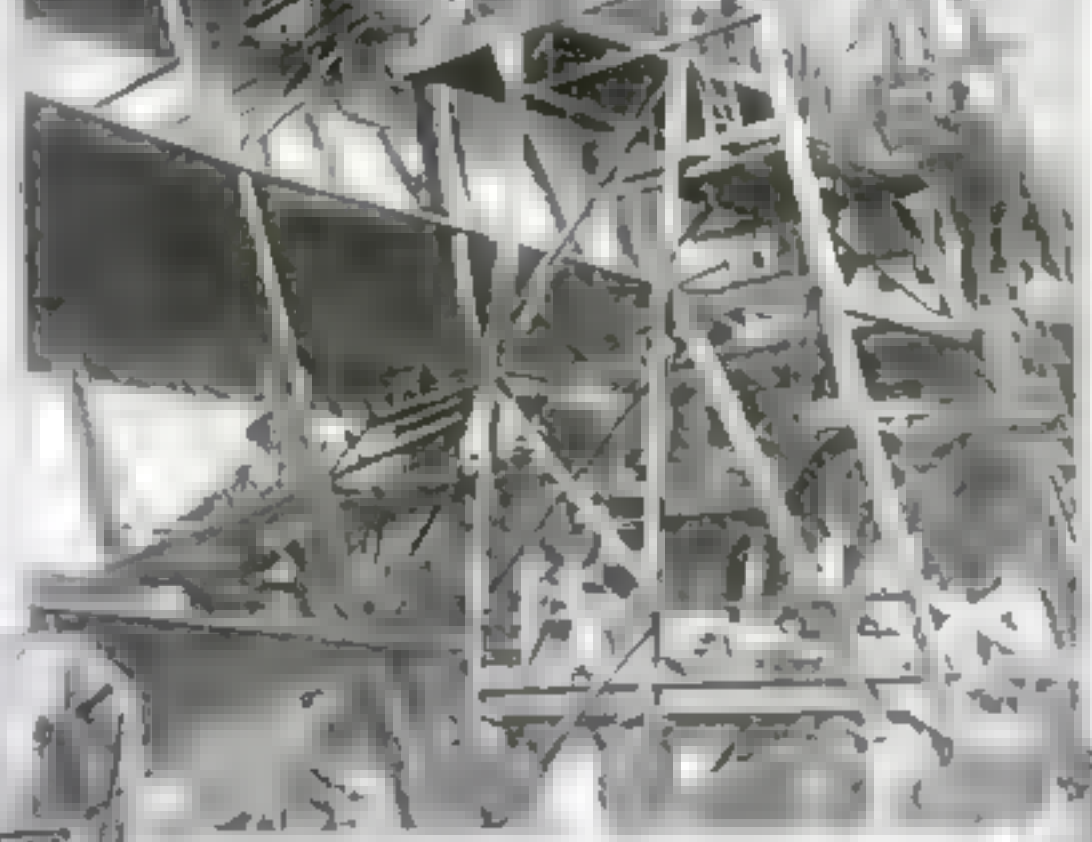
A propeller is shaped the very reverse of a crank, having a sharp edge exactly where there should be a handle. The moment the motor starts, it becomes necessarily as dangerous as a striking serpent.

"Why not use a self-starter?" you ask. Its weight while the airplane is in flight greatly hampers the airplane's power. However, a detachable starter invented by M. Odier, a Frenchman, is now being used on many French airplanes. It is mounted on a bipod, and can be worked by one man.

A tube filled with liquefied carbonic acid is attached by a metal pipe to a long steel cylinder containing a piston. These are located on the longer leg of the bipod. A pulley is fastened to the piston, and over it stretches a cable that comes from the cylinder. The cable travels on, and is wound four times around a grooved drum, being fastened then to an elastic cord. The drum is mounted on a shaft together with a bell-shaped projection that is made to fit into the hub of the airplane propeller. Four bolts on this bell-shaped projection slide into grooves in the hub.

To start the engine, a man presses a lever that releases the carbonic acid. The piston then shoots out, and with it goes the pulley. The cable gives the drum a twist sufficient to [illegible] over.

Now that the engine is started, how is the starter detached? You remember the bolts on the [illegible] projection and the grooves into which they fit. These grooves are cut at such an angle that the bolts are forced out when the propeller whirls. Then all the attendant has to do is to carry the [illegible] away.



A Frenchman invented the detachable airplane starter at the right. It is operated by the release of carbonic acid against a piston, which whirls a drum connected with it by a cable. The drum is mounted on a shaft, together with a bell-shaped projection that fits into the hub of the propeller, as shown on the left. When the drum whirls around, so does the propeller

Copyright Wide World Photos

These men are making experiments for the purpose of determining the heat-saving value of pipe covering compositions

Heat Saved Is Money Saved

WHAT are these men doing with this complicated apparatus that ranges all the way from a vacuum flask to pipe covering?

The pipe-covering explains it. It is assembled for the purpose of measuring the efficiency of different pipe-covering compositions, and is used by the students at the Massachusetts Institute of Technology

The embryo engineers make their own readings and calculations, and much interesting data has been gathered. Among other things, it has been found that, by using a standard covering, a saving of $1,500 a year is made on 1,000 square feet of 10-inch pipe surface, when the inside temperature of the pipe is 400° F., and coal is ten dollars a ton.

Steel Legs for the Work-Bench

A GOOD work-bench is necessary for good workmanship; it must be light and strong and rigid and altogether carefully planned if it is to give first-class service.

Such a work-bench is shown below. The legs are made of U-shaped pressed steel, and have wide base-plates that are screwed to the floor. Even when they are stationed as much as eight feet apart they will yet hold the table in a perfectly rigid position

The U shaped legs of pressed steel have base plates that screw to the floor

The wooden table-top is attached to a metal frame that is electrically welded to the legs. The front half of the table-top is of double thickness, and the back half is finished off with a vertical board to keep the tools from slipping off

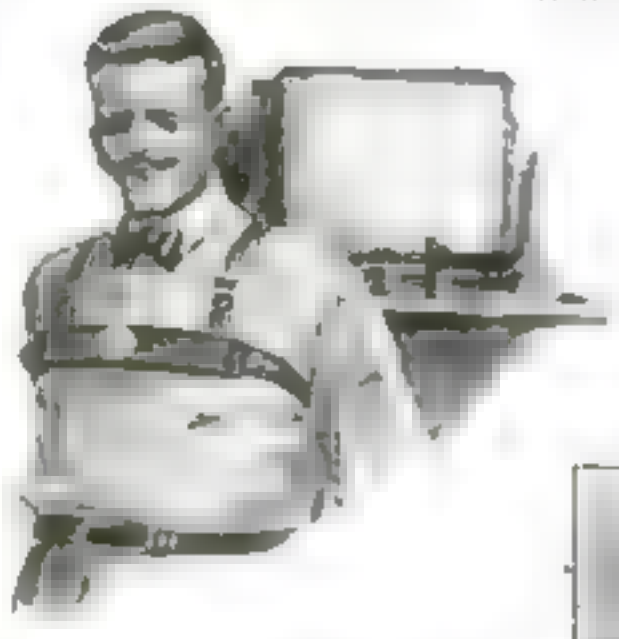
The work-bench can be made to almost any length that may be required. It may run down the entire length of the work-room. A drawer for holding tools is located in a central position between each pair of legs, which, by the way, are made more firm by a strong metal bar running from each front leg to the back leg corresponding to it

Since the screws in the base plates are the only means by which the work-bench is made stationary, you can readily see the ease with which it can be moved.

One Way to Keep Straight

CLANG! You jump with surprise as the bell sounds, for it seems to come directly from the chest of the man you are talking to. As a matter of fact, you discover that it does.

He is wearing what is known as the incorrect-position indicator, and every time his chest caves in a bell sounds, warning him to throw his chest out again.



Every time his chest caves in a bell rings the bell is operated by the harness he wears

The indicator was invented by George T. Boylan, of Hartford, Conn. It is made like a harness, having a belt that fits around the chest, and a pair of shoulder-straps. A long flat case attached to the ends of the belt contain the bell and the wherewithal to ring it. One end of the belt is fastened securely to the case, but the other end is attached by springs. Thus, when you cave in, the springs contract. A lever attached to the sliding end of the belt moves back and forward as the springs contract and extend. This causes a geared wheel to turn. The wheel meshes with a second wheel, and this also, in consequence, turns. A contact point connected with the battery is mounted on the second wheel and is located —when the wearer stands properly—midway between arms of a metal fork which is also connected to the battery. These two contacts—the point and a leg of the fork—must touch before the bell will ring.

A Mule's Daily Bath

THIS mule gets a daily shower-bath, and so do all her sisters who work with her in the mine.

The shower is equipped with three large nozzles that shoot a continuous spray of water down on the mule's head, body, and tail Perforated pipes along the sides of the shower-bath help to clean the day's accumulation of dirt from the mule's tired body

This daily cleansing of the mule undoubtedly adds to her days of usefulness.

This mule works in the mines every night she is given a shower-bath, and this keeps her good-natured

Through the Breakers on a Surf-Boat that Can't Sink

Sliding home; he's safe! It needs no umpire on the shore to tell us this. And it makes no difference whether you can swim or not—whether you are fat or thin—the surf boat is so buoyant that you are always bound to come out on top

He is as [illegible] the boat that looks [illegible] [illegible] get a mouthful of suds. While gripping the grooves in the sides of the fish he can't sink

Four men and a boy—all grinning. It's no wonder—each has a surf boat made of balsa wood—which is the lightest wood in the world, and they can ride through the breakers without sinking as long as they hold on tight

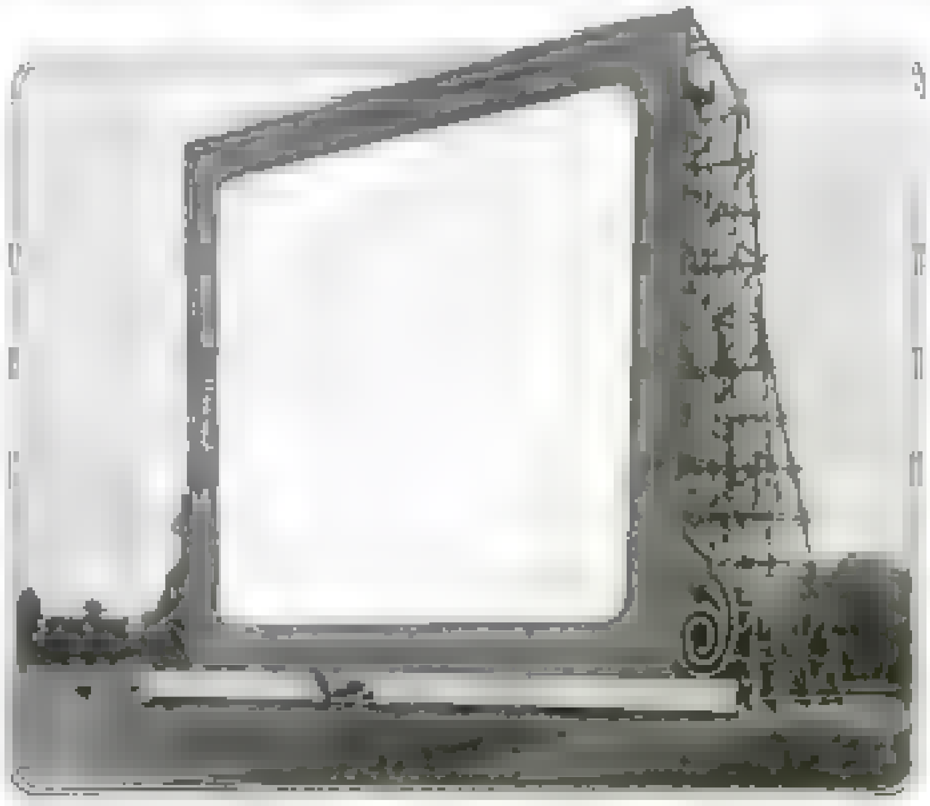
A Monster Movie Screen

ADVERTISING billboards and moving-picture screens grow larger and larger. Which of the two is the monster shown here? Since it's outdoors, one would naturally call it a billboard, but it proves to be a moving-picture screen, one hundred feet square—the largest in the world.

It was erected on the fair grounds at Columbus, Ohio, for the Methodist Centenary and cost more than eight thousand dollars. One hundred thousand square feet of lumber was used in the frame, and the screen itself is made of matched, smoothly planed boards painted white.

The pictures are thrown on this screen by nine projectors from a distance of one hundred and thirty-five feet, and one hundred and ten thousand people can see it.

Imagine a close-up of Mary Pickford on a screen like this, her face would be about fifty feet wide and each eyelash would be nearly a foot long!



Copyright Keystone View Co.

This moving-picture screen is supposed to be the largest in the world, it is one hundred feet square

Wood and Heat

WHEN you stop to think of it, isn't the most popular kettle cover in your kitchen the one that has a wooden knob on the top? No matter how hot the tin or agate or aluminum may get, you can always lift it off by the wooden knob without burning your fingers. This is because heat passes through wood much more slowly than it does through metal, and that is why wood is used so generally for handles of all kinds. Its low conductivity also explains its use for refrigerators and fireless cookers.

Woods differ among themselves as heat-conductors. Heavy woods, like oak, conduct heat more rapidly than do light woods, such as spruce, and all woods conduct from two to three times as much heat with the grain as across it.

Stone and concrete conduct heat from ten to thirty times as fast as wood, and that is one reason why wood is more desirable for floors and walls.

The Motor that Rocks the Cradle

"ROCK-A-BY, baby, on the tree top, when the wind blows the cradle will rock"—uncertain rhyme and an uncertain way of putting the baby to sleep, the wind may not blow.

Luther P. Jones, of Russellville, Ala., has invented a cradle that will swing constantly, regularly, and automatically, needing neither wind nor hand to rock it. A motor does the work. You wind up the spring when you want to start it. The motor turns a wheel that causes the bar supporting the cradle to swing. In the words of the patent paper, "the clock mechanism has an escapement connected with and adapted to actuate the oscillatory member."

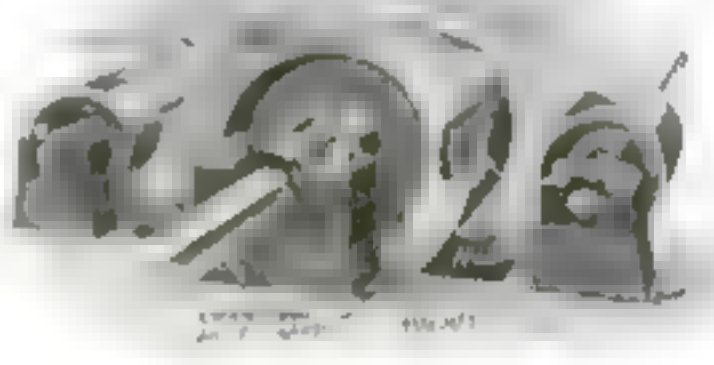
The cradle hangs on chains that terminate in the bar leading down from the motor and its attachment above. Thus, you see, if the baby should not care for sleep he will be interested in the wheels above and will forget to cry

In the picture above one pair of parents are about to desert their sleeping child for a moving-picture show. They have wound up the spring, and the cradle is going strong

If you do not think a motor and wheels are dainty enough to be seen on your baby's cradle, you can easily make a cover for them out of a little cretonne. Or do you disapprove of cradle-rocking?

Perhaps you believe that crying is good lung exercise for babies.

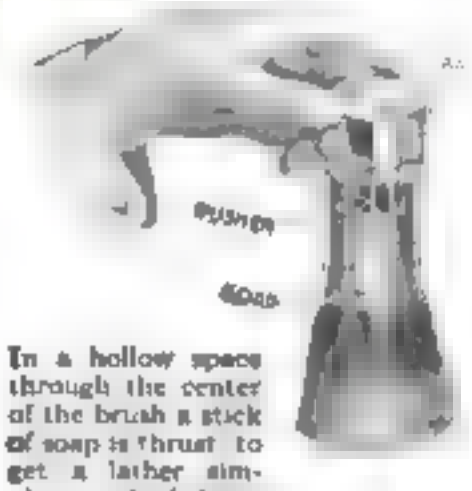
Don't waste time rocking your baby's cradle; let a motor rock it for you. When baby wakes he can watch the wheels go round



This magnetic pulley is made to carry a thin steel belt which makes great speed possible

Soap and Brush in One

"WHERE'S my shaving soap?" you ask." Baby's fed it to the cat," you are told. If the soap and brush were one there would be no chance of losing one half without the other, and lathering would become much simpler. Below you see a shaving-brush having a hollow handle, so that a stick of soap can be passed through it to a point within the bristles. A pusher attached to the cap forces the soap along the interior of the handle. If desired, the cap can be threaded, in which case it is turned to adjust the soap.



In a hollow space through the center of the brush a stick of soap is thrust to get a lather simply wet the bristles

Play Solos and Accompany Yourself

IF you strum a guitar, or tinkle a mandolin, either learnedly from music, or irresponsibly by ear, you have probably tried to play a harmony on the bass strings, while carrying the air on the treble strings. After spraining two fingers and tying the rest in knots, you have given it up in despair.

Elmer S. Tanquary, of Lawrenceville, Ill., has perfected a device that will finger the bass strings of a guitar, or other instrument, for an accompaniment, while the air is played in the ordinary way The accessory clamps on to the neck of the instrument, and is worked with a rod attached to the little finger of the right hand. It is a small triangular block, with bars underneath, so arranged that they depress the bass strings at the proper frets to make simple chords.

It is equally applicable to other string instruments besides the guitar.

One-Inch Belt Carries 1,000 Horsepower

MAGNETIC pulleys in themselves are not new, but the older types carried a heavy laminated belt, while the one pictured above carries a light, single-thickness band

The new pulley is made with a pair of close spiral grooves, technically known as helical grooves, which run parallel to each other around its circumference. In each of these grooves is wound wire to form an electromagnetic circuit Current, fed through "slippings" at the hub, is passed through the two coils. It passes through one in one direction, and through the other in the opposite direction. In this way what is called a magnetic field is created, the two poles of the magnet being the two parallel helical grooves.

By making the magnetic field practically cover the surface of the pulley, great attractive force is obtained. In consequence it is possible to use a very thin steel belt, which is made in one piece or brazed together. The belt should not exceed .06 of the diameter of the pulley.

The steel belt and magnetic pulley combination has tremendous driving power and will run at great speed. With a pulley fifty inches in diameter, running at eight hundred revolutions a minute, a one-inch belt will transmit one thousand horsepower

Steel belts may be safely run at a speed of eighteen thousand feet a minute. They are consequently useful for transmitting power from turbines.

By using the mechanical fingering device you can do without the friend with a ukelele

Fighting Flaming Oil with Foam

A MASS of twisted sheet-iron and pipes from which rivulets of oil, gasoline, and naphtha continue to burn is all that remains of the great oil plant. The blaze gave the fire department the hardest twenty-five-hour fight in its history, but there is no longer danger of the flames spreading, as all the damage that could be done has been accomplished. The loss is estimated at $1,500,000."

That is the report of one New York newspaper, written on the fourth day of the great oil fire in Brooklyn last autumn. The firemen had to fight the blaze with water and sand. These were inadequate for the purpose, and the only thing to do was to let the fire burn itself out, at a tremendous loss.

Non-Inflammable Bubbles

Chief among oil-fire quenchers is suffocation by foam. The great non-inflammable bubbles are poured over the surface of the oil, and the fire quickly subsides. The bubbles are made by combining sulphuric acid with bicarbonate of soda. Carbonic-acid gas is thus formed, and it quickly suffocates the flame. Many oil-storage plants are now equipped with these bubble tanks, and some of the tanks work automatically. Thus, should a fire start when no one is near, the tank will see that it is put out—perhaps before any one arrives.

A large oil-storage tank was being built at Midland, Pa. The first ring, about five feet high, had been erected on the foundation, when the owners suddenly decided to try out their new automatic extinguisher. They poured two feet of water in the ring then eighty barrels of crude oil, and on top one hundred gallons of gasoline. They soaked some cotton waste in kerosene, set it on fire, and threw it into the tank.

The flames burst forth, and two minutes later the foam began to flow. Two minutes more, and the fire was out!

Foam-Pipes Solve Problem

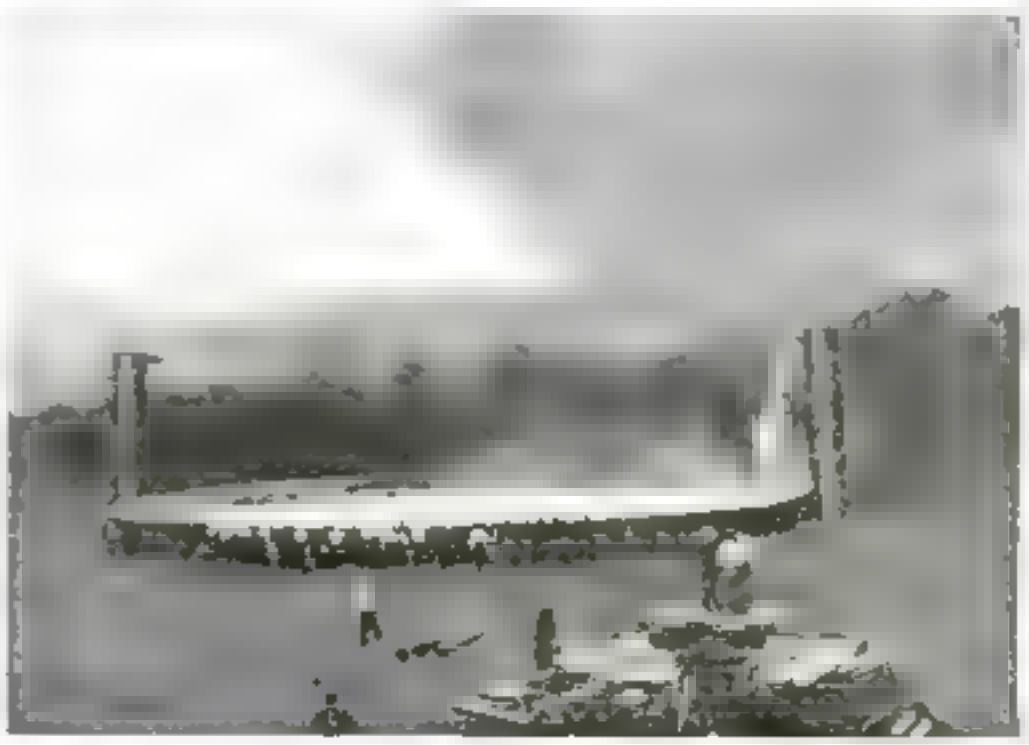
The pictures of this fire test show the two stand-pipes, one on each side of the tank. Both of them contain the foam-making liquids. The one on the right was used for this particular fire. Bicarbonate of soda and soapbark dissolved in water are kept in the bottom of the pipe. An acid-tank for the sulphuric acid is mounted above the level of the soda solution. A pipe leads down from the tank to the solution below

At the place where the acid-tank and the pipe meet there is a glass plate to keep the acid from rushing down the pipe under normal conditions. A plunger is mounted directly over the glass, and above the plunger there is a hammer, held in place by chains which have links that will melt when heated to 212° F. Thus when the fire was started the links melted, the hammer dropped on the plunger, the plunger broke through the glass, the acid ran down the pipe, mixed with the soda and the foam came bubbling out of the spout of the stand-pipe.

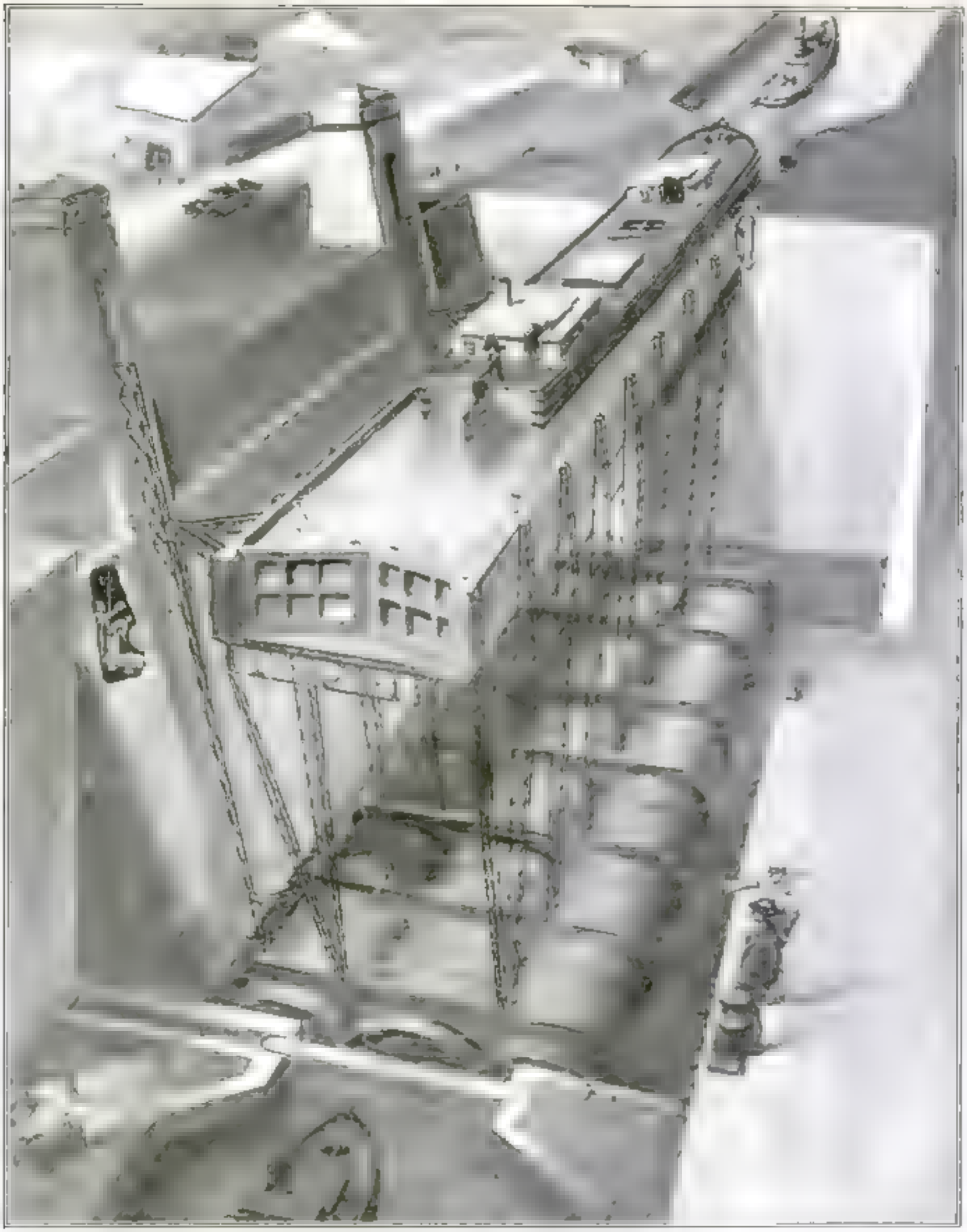
There are many other ways in which foam-pipes may be made to work automatically. In one instance, the valves that let loose the liquids were worked by electricity; the heat melted a fusible connection that started the current.

To test a new automatic oil-fire extinguisher, flaming cotton waste was deliberately thrown into this tank when the heat of the fire reached the pipe at the right, things began to happen

The pipe contains two tanks, one holding bicarbonate of soda and the other holding sulphuric acid, when these are mixed a foam results that contains carbonic-acid gas. This gas suffocates the flames



Two minutes after the foam started to flow over the burning oil the fire was out Since the foam method has proved to be so successful it is being installed in many oil plants



A New Lock that Saves Water in the Upper River

The lock shown in this picture is the invention of a German engineer and seems to solve the problem of overcoming great differences of level in river navigation at a minimum of cost and without draining the river on the higher level of too much of its water. The water-filled tank which holds the [illegible] steel structure supporting [illegible] are balanced by [illegible] which relieve the burden on the hoisting machinery

A Lock that Does Not Waste Water

It combines the principles of the ship railway with those of the basin lock

By Ernest Welleck

WHEN two navigable rivers are to be connected by a ship-canal, one end of which is considerably higher than the other, locks must be constructed between the two rivers. Otherwise the river on the higher level would lose a great amount of water which would flow through the connecting canal into the lower river

If the locks are used frequently, the consumption of water may seriously impoverish the volume of water in the higher river. It is true the water necessary for operating the locks may be taken from the river on the lower level and pumped to the locks. This would not interfere with the navigability of the lower river, as the water taken from it would be returned to it after having been used in the locks. But the pumping of water, especially to a much higher level, is very costly and consumes a great deal of time.

Ship Railway and Basin Lock

A German engineer has invented a method of overcoming all these difficulties by a combination of ship railway and basin lock. The ships passing through the lock are carried in a water-filled tank of reinforced concrete resting upon a substructure of latticed steel which constitutes the truck frame of the carriage. The entire structure does not, however, rest upon wheels running on an inclined track as in the case of the ordinary ship railway, but on three large and air-tight cylinders of reinforced concrete. When fully submerged these cylinders support not only their own weight but also the weight of the steel carriage and of the water-filled tank.

The lock basin, wider at the top than at the bottom, forms a trough lined with reinforced concrete and is inclined on the side on which the hoisting and lowering machinery is located.

Let us suppose that a ship is to be lifted from the lower to the upper river level. The car, with its steel structure and the water-filled tank resting on the air-filled concrete cylinders, is ready at the water-gate. The water in the tank is on the same level as that in the lower river. The entire weight of the carriage is buoyed up by the cylinders, and there is practically no weight on the wheels or rollers, which are resting on the track of the ship railway. The sliding water-gate is opened and the ship is admitted to the tank.

Supported by Air-Tight Cylinders

After the gate has been closed, the propelling mechanism, driven by steam engines or electric motors, is started, and the carriage, now with the extra load of the ship in the tank, begins its voyage toward the other end of the lock.

Since the level of the water in the lock is the same in all parts of the lock, while the carriage moving on the inclined plane of the track is steadily emerging more and more, it is clear that the burden upon wheels, track, and engines increases gradually as the carriage moves toward the upper river end of the lock. Yet, the greatest burden that is likely to be imposed on the moving mechanism under the most unfavorable conditions is estimated at a trifle more than one hundred tons, the rest of the burden is supported by the buoyancy of the air-tight cylinders.

Through in Twenty Minutes

When the carriage reaches the upper river end of the lock, only the cylinders are submerged. The tank is high above the water in the lock, and its water is on the same level as that in the the upper river. The sliding gate is opened and the ship passes from the tank into the waters of the upper river. It is calculated that the average time required to carry a twelve hundred-ton ship through the lock will be about twenty minutes, assuming that the difference between the upper and the lower river levels is not less than thirty and not more than seventy-five feet. The cost of constructing a lock of this kind is considerably smaller than that of an ordinary lifting lock.

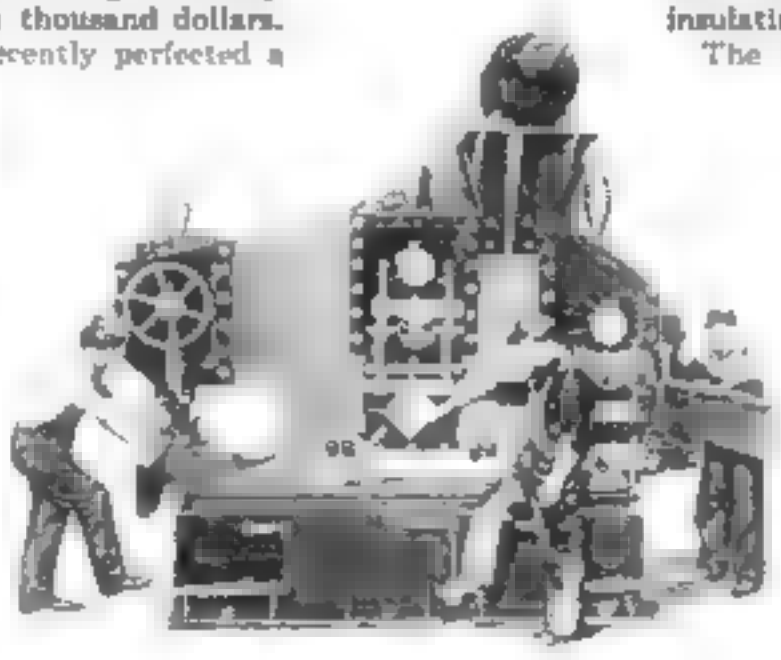
It Does Five Machines' Work

IF by scrapping five machines and buying one you could save space worth hundreds of dollars, would you do it? Space is valuable. A recent article in the POPULAR SCIENCE MONTHLY estimated the cost of the space for two ordinary desks in New York (a space covering some fifty by sixty-four inches), as thirteen thousand dollars.

A Chicago manufacturer has recently perfected a machine that takes the place of five others. It embodies in itself convenience for shearing plates and round and square bars, coping and notching, section cutting, and punching, without the necessity of changing any tools or attachments.

Several operators may use the machine at the same time without getting in one another's way, for the various operations are completely independent of one another. The control of the machine is by foot levers, through gears and clutches.

Work of practically any size can be manipulated, for the girders, bars, etc., are not impeded in their passage through the machine.



When one machine can do the work of five, floor space can be laid out with greater economy These three men are using the machine for three different operations

Sea-Grown Insulating Fiber

MATTED beds of fiber, seven feet thick in some places and several square miles in extent, have recently been discovered on the seashore of South Australia in the region of Posidonia. This is a valuable find, for the fiber is excellent material for insulating steam-pipes and refrigerator plants.

The beds are formed from the withered stalks of a plant which is not a seaweed, but which resembles rather a flowering land plant except for its habit of growing under water. Its withered straw-shaped leaves wrap themselves around the stem and after a time form a dense matted bed of fiber on the bottom of the ocean, which here is shallow. From this bed a new growth of fiber springs, withers, and in turn becomes the ground for another growth, so that the bed grows constantly thicker.

It is estimated that the whole deposit contains 4,500,000 tons dry weight, and the South Australian government foresees from its exploitation a rich new industry.

The post, with the guy-ropes attached is on its way across the forty foot space to its new location

Moving Poles without Disturbing Wires

POLES carrying 66,000-volt wires, 2,300-volt wires, and telephone wires, followed a country road. The course of the road was changed, and the poles had to follow.

The pole to be shifted was supported with guy-ropes at right angles to the line of posts, and a pole-jack was used to uproot it. A two-ton motor-truck then appeared on the scene, and the sixty-five-foot pole was secured to its rear end. The truck, with its unwieldy burden swaying and trembling, backed slowly up to the new post-hole forty feet away. The linemen rapidly cast off the lashings and lowered the pole into its new home.

It was found possible to move all the poles in this way without untying the lines at any point.

When Mother Earth Tips the Scales

THE earth weighs 6,000,000,000,000,000,000,000 tons. Can you pronounce it? We suspect that Professor Louis E. Dorr, head of the department of physics at the Massachusetts Institute of Technology, who weighed the patient, speaks of it lightly as "six and twenty-one ciphers tons."

The weighing was an elaborate process. First, two small spheres were weighed with the finest accuracy and freely suspended from the end of a short rod by threads made of quartz one twelfth as thick as a human hair.

Next, two lead balls weighing about ten pounds each were brought into the proximity of the suspended balls, and the influence of their superior mass immediately changed the position of the smaller balls. The force that did this was calculated to be equal to the weight of a human hair one hundred thousandth of an inch in length.

Knowing the weight of both sets of balls, and having determined the force that the lead balls exercised on the suspended ones, also knowing the power of the earth's attraction upon the lead balls, which is their weight, the final calculation of the weight of the earth became simply a problem in proportion.

Eat by the Light of Your Lunch Pail

LUNCH pails mean lunch-time, and lunch-time means noon to most of us; but not to Clarence M. O'Neel of Eagle Creek, Ore. He eats his lunch at night—or at least the lunch pail that he has recently invented would seem to indicate that he does.

The unusual feature of Mr. O'Neel's lunch pail is that it is equipped with an electric torch to enable the luncher to see what he is eating.

At first glance the pail looks like an ordinary satchel, but you soon notice that the opening is at the bottom, and that one end of the top is separated from the main body of the pail and wears a cap.

Underneath the cap you will find the lens of the torch. The cap is used to protect the lens when it is not in action.

The switch that controls the light is located directly under the handle of the pail. Beneath the torch, the pail is divided into two sections, the upper one holds a vacuum bottle, and the lower one the lunch. The bottle has two uses—it will hold coffee, and will serve as a hat-rack for the cap when the cap is taken off the lens.

For those who eat their lunch at night this lunch pail has been invented. It is provided with an electric torch, so that one may see what he is eating

Iron Roses Fresh from the Anvil

This smith, a mighty man is he. He hammers out not horseshoes but roses

WHERE are the blacksmiths of yesterday? Still hammering, most likely; but few of them are working on horseshoes. For example, James Cran, of New York, hammers iron into roses and sells them to an admiring public. Below you see a bouquet of iron roses tied with an iron ribbon. One leaf is abnormally large, to act as a card-tray

When a flower is made, the different parts—petals, leaves, and calyxes—are forged separately The veins, ribs, and rough edges are made by the peen of the hammer. Mr Cran can make a spray of leaves in half an hour, but it takes him at least two hours to reproduce a rose, with all its fine, interlaced petals.

Other flowers he makes as well Once he hammered out a Scotch thistle for Andrew Carnegie. Both men were born in Scotland.

This elaborate card-tray of roses, leaves, and ribbons is made of iron, hammered out by a blacksmith

Getting Ready for the Winter Hike

By Charles Coleman Stoddard

Two light weight garments are always warmer than a single one of their combined weight

HAPPILY the day is past when most of us feel that winter is a shut-in season, that the open air means colds, tonsilitis, or pneumonia. With proper clothing and equipment, we may even stay out overnight, or plan a protracted camping trip. Perhaps even as you read this page the snow is falling. You are fortunate if tomorrow is a holiday; for that may mean a long hike along the drifted roads and across the snow-covered fields. If you are in camp, nothing gives the same thrill as to wake in the morning and find that silently through the night the cold hand of winter has spread a white carpet throughout the wide world.

Some of the most gorgeous sunsets are found at this time of the year

Imagine setting out in early morning for a long hike across a boundless landscape of unspoiled, unbroken snow. It makes the blood leap even to think of it. There is no need for roads, even the hillside path has lost its familiar aspect. Our way leads us across fields, over frozen brooks, through the now open woods, the winter view is so wide we are amazed at the way the world has shrunk; we attempt short-cuts we would never dream of in summer when we would be certain to be mired in swamps or lost in the thick foliage of the underbrush Whether we walk for the sheer joy of motion, or whether our quest leads us to the study of winter birds, or to the intimate observation of the mysterious and fascinating tracks of animals that cross our path from every hand, we are sure to be rewarded a thousand times over. The keen air quickens the blood and brings color to the faded cheek, calls back the lost health and indiscriminate hunger of youth.

The Two Don'ts

The two most important cautions for winter hiking are *not to overdo*—not to walk too far nor too fast, nor to pack too heavy a load; and not to wear *too much clothing*—save most of it to slip on when resting or loafing about camp.

The invigorating air and the joy of facing nature in her most boisterous moods offer a strong temptation to go to the limit of endurance; but it is a mistake to overtax oneself unnecessarily, especially in winter. Anything that tends to exhaustion lowers the resistance of the body to cold. Therefore, measure your stride and your distance carefully, and always aim to come into camp in ample time to make all preparations for the night, to have the bed ready, an abundant supply of firewood, and the evening meal out of the way before dark. Eat regularly, even on the road, it is well to have a luncheon in the pocket—a sandwich, or bread and peanut butter, or chocolate. The out-door life, particularly in cold weather, increases the appetite immensely, and any physical depression, from hunger or any other cause, must be carefully guarded against. You may pride yourself on being able to pack all day in the summer on an empty stomach; but remember that heat, bodily comfort, and the ability to resist cold, all come from the inside, and that the fires of the body burn out more rapidly with the frost and ozone of winter days.

Overheating the body through hard exercise, with the consequent sudden chilling, is infinitely more dangerous in winter than in summer. One always must be prepared for the halt and for a sudden drop in temperature.

Winter Clothing

Two light-weight garments are always warmer than a single garment of their combined weight and of the same material. For the same reason, a loosely woven garment is warmer than a closely woven one, because of the dead-air it contains. Rubber, leather or other waterproof garments should not be worn while exercising, as they induce perspiration and do not permit it to pass gradually away from the body. A loose garment of khaki, canvas, or other closely woven material (not waterproofed) may be worn as an outer garment to shed snow or rain or to prevent too rapid dissipation of heat in the wind, but cotton, linen and silk retain moisture much longer than wool and become cold and clammy, and should not be worn in winter except as some such outer garment.

Loosely woven woolen garments, of moderate weight, are the best for all occasions on the road. One or two suits of medium-weight woolen underwear, a good flannel shirt, woolen trousers, light woolen socks and a heavy pair of woolen stockings pulled on over these and drawn up over the legs of the trousers, and strong, waterproof footgear, is the most satisfactory outfit and about all one will care to wear while in action even in temperatures far below freezing. The extra clothing goes into the packsack.

"Knickers" for Women

Clothing for women should be of the same materials as that for men and the nearer it approaches the latter in the cut of the garments the greater will be the comfort of the wearer. Long or tight skirts should never be worn into the woods and under winter conditions make proper walking impossible.

A good sweater is a great comfort, particularly if made in the coat style with a high rolling collar. Those with a long, loosely napped finish hold a larger amount of air and are consequently much warmer. Or you may prefer the popular "stag" or "cruiser" shirt, of twenty or twenty-six ounce mackinaw, which can be worn either inside the trousers or allowed to fall outside like a coat. The new "beach cloth" garments are practicable and reasonable in price. This material is fleece-lined, with a tightly woven, windproof outer fabric, and worn over

You can make yourself comfortable by the method shown in the above illustration. The fire is essential in cold weather

woolens is certainly warm. The mackinaw or other outer coat should have a broad belt all the way round, to close the air space and to hold it snugly to the body in the wind. But it is important to avoid all constriction in the clothing, belt, garters, shoes or mittens. Anything "tight" to the feeling is interfering with the circulation of the blood, and the part cut off is certain to be cold if not to freeze.

Unless you plan for snowshoeing, cruisers or heavy, oiled high shoes are better than moccasins for hiking. If the latter are used, oil-tanned ones are best when the going is likely to be at all wet. Ordinary rubber and cloth arctics, worn with insoles and heavy socks are also practical, and may be used with the snowshoes. Have the shoes soft and comfortable, with strong soles, but not so heavy as to be a burden, and large enough to permit wearing two or three pairs of heavy stockings in very cold weather. When a less number are worn, take up the space with cork or hair insoles to avoid friction and chafing the feet.

Remember Your Hands

Mittens are warmer than gloves, as they do not constrict the fingers nor divide the dead-air space. They are now made with a separate forefinger as well as a thumb, which enables one to handle small objects without exposing the hands. A good plan is to have a larger and outer pair attached to the ends of a long elastic band passing over the shoulders and through the sleeves of the coat.

You will want a good, warm cap that can be drawn snugly down over the ears. A fur cap may appeal to you, and is a luxury, but any one of the many woolen caps is equally satisfactory—and perhaps even more so, unless you are in the far north or the weather is extremely cold. You will find your sleeping helmet comfortable on a very cold day. It protects the face and neck, as well as the ears. The cap should always have a visor, to shut out the glare of the sky.

If the days are bright, the reflected light from the snow will also prove an annoyance, and even a danger if long continued. A pair of rubber-framed automobile goggles, with the glasses only slightly colored or smoked, will be found very restful, as they also shut out the troublesome reflections from the side. Spectacles are always more comfortable than eyeglasses in the woods or in the wind, but in cold weather care should be taken that no metal parts touch the skin. The bridge and the bows should be cork or rubber covered, or they may be wound with woolen yarn. They may be worn under the goggles.

Lost in the Snow

Before setting out on a winter hike, even when reasonably familiar with the country, it is well to study the maps carefully, and to carry them where they can be consulted frequently without digging too deeply into the clothing. The absence of foliage and the heavy snowfall change the landscape so completely that the most familiar landmarks seem strange. And never, in winter, venture into the woods without a reliable compass and knowledge of how to use it. Of course, if lost, you may follow the back track in the snow, and sun and stars may guide you, if you can see them, but a sudden snow flurry may confuse all sense of direction, and in a drifting wind all tracks may be obliterated

Tramping miles through the brush and snow sharpens the appetite to a keener edge

If you are hopelessly lost, do not attempt to go on until you are exhausted. Stop where you are and use your remaining strength to prepare for the night. Scoop out a trench down to the bare ground, and in one end of it build a small fire; about the other end, throw up a rough lean-to of brush, bark and boughs banked with snow, to protect yourself from the wind. A small fire is better than a large one, for you can crouch over it "Indian fashion" and keep warmer than by a large fire that will fry your face and freeze your back—a small fire, too, will need more attention, occupy your time, and help to keep you awake. By all means, keep awake! It will require some effort, but do not, under any circumstances, go to sleep. Such a bivouac in the snow is not dangerous, scarcely uncomfortable in fact, I look back upon one or two similar occasions with distinct pleasure. At daybreak, take up the tangled skein. You will have rested, and collected your wits, and the chances are that it will not be long before you untangle it.

Mealtime

While a luncheon of some sort is a necessity on a winter hike, if we make it a hot meal cooked in the snow-covered woods, we have a luxury never to be forgotten. It is wonderful how the most jaded appetite awakens after a few miles of winter walk, how the stomach calls for hot food. Then there is the romance of the glowing fire, the cheerful cracks and songs, the ruddy, healthy faces, and the satisfaction of having beaten the Red Gods in their very lair. The menu need not be elaborate: a steaming kettle of tea with plenty of sugar, hot toasted bread with slices of boiled ham extra-broiled on a split stick over the fire, a can of beans or spaghetti, or a sizzling pan of bacon. Just empty the beans into the hot bacon and brown them. It will give them an extra flavor, and you will relish more fat, and more sugar, than you ever dreamed of, in the cold and in the open. A generous slice of homemade pound-cake and a comfortable pipe—the gods themselves could not ask for more.

The outfit for such a meal is not a burden and amounts to nothing if there are several in the party. You need some sort of a packsack anyway, in which to carry your spare clothing when on the road

If you feel that you are not hardy enough to remain out all night, by all means try one evening meal in the snow, and tramp home after dark. The glow of the camp fire across the snow is never to be forgotten; the glory of the winter stars, that seem near enough almost to be within reach, the cold moonlight across the valley, the black files of cedars marching like an army across the hills.

I remember one such bivouac when all evening the snow was falling silently about us, heaping upon our caps, shoulders and backs until we seemed some queer, unearthly creatures of the frozen world. The tree-trunks glowed warmly in the firelight and from far away came the low complaint of an owl. Then came the long march back through the deepening snow, when we romped and sang as children, until a single, far lighted window spoke to us of home, with dry clothes, a warm fire, apples and cookies, a dreamless sleep, and another joyous morrow in the open.

When the ducks are flying low it's an easy matter to step out of the shack and bring down a few for dinner

What determines your selection of a truck tire?

Mileage? Kelly Caterpillar tires carry the greatest mileage guarantee ever put on a truck tire—15,000 miles.

Traction? No other truck tire can possibly deliver the engine's full power to the road as the Caterpillar does, because no other tire has the road-gripping qualities which its patent-protected construction gives

Resiliency? Its greater depth of rubber would alone make the Caterpillar more resilient than the ordinary type of truck tire In addition to its unusually high profile, however, the Caterpillar has a system of side vents which enormously increases its resiliency by enabling the rubber to flow under load.

These are a few of the reasons that are leading the biggest fleet-operators in the country to replace their old tires with Kelly Caterpillars.

KELLY-SPRINGFIELD TIRE CO.

GENERAL SALES DEPARTMENT

4614 Prospect Avenue, Cleveland, Ohio

Protected by U. S. Patents
June 20, 1904 Mar. 14, 1916
Aug. 31, 1915 Feb. 29, 1916

Positive or Negative—Which is Which?

How to distinguish the poles of a battery when surface markings have been obliterated

By Windsor Crowell

LET'S suppose that in front of you sits a storage battery. Its polarity markings are obliterated, yet the situation demands immediate action. Do you know how to determine the negative from the positive pole?

"Oh", you say, "I can test it out with my voltmeter or can tell by the color of the battery plates."

That's fine—until you discover that your voltmeter is at home and that the battery casing is not transparent but is like a brick wall, and the plates are completely hidden from sight.

Bubbles rise from both wires but a great many more come from the negative wire than from the positive

Then you will have to admit that you are in a pretty fix and no mistake.

But—if you can discover a potato patch nearby—the day is saved. Just sneak over when Farmer Brown isn't looking and lift a good big spud from a hill. Shave off the skin from one side so a goodly portion of the meat is exposed and set it down alongside the battery. Then take a terminal wire in each hand and press their bared ends into the shaved section of the potato about an inch apart.

See that? The potato in contact with one of the wires commences to discolor until it finally shows up as a conspicuous spot of green. What does it mean? Why, simply that this particular wire is attached to the positive pole of the battery. So that settles it. The other pole must be the negative one.

But—suppose you happen to be in a desert, on a mountain side, or far from a potato patch or a grocery store—what then?

Pour out a little of the electrolyte solution from the battery into a glass, place both wires in it, keeping them well apart, and watch the result. Bubbles will rise from both wires, but a great many more will come from the negative side than from the positive. This test is always sure.

Now, on the other hand, why not be prepared for this very emergency and carry an infallible test with you? It costs little and may come in mighty handy some day.

Buy a section of stout glass tubing (steam gage tubing is good), about 6 in. long. Next get two rubber stoppers to fit the tubing and force a common dry battery terminal through each stopper. Next comes the solution. As alkali always surrounds the negative pole such a presence can be ascertained by placing the negative wire in a neutral solution. This solution is made by dissolving about six grains of sodium sulphate in two ounces of water. Then add a few drops of phenol phthalein. Stop up one end of the tube, fill it nearly full of the solution and then push in the other stopper. Be sure the stoppers fit tight so leakage will not occur. Seal the end if the tube is to be carried about much.

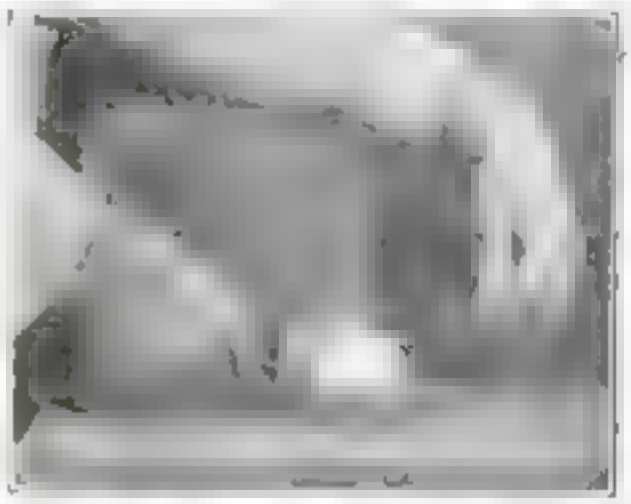
Connect the two wires to the battery and watch what happens

In its normal state the solution will be colorless. But connect the two terminals to the battery wires, turn on the current and watch.

The phenol, which remained colorless in the neutral solution, will gradually assume a reddish purple hue about the negative pole and remain so as long as the current is kept on and the liquid is undisturbed. When the current is disconnected, shake the tube and the color will disappear.

Paper soaked in the foregoing solution will show the same phenomenon, when a current is applied.

If you are doubtful as to the polarity of the charging circuit, dip the ends

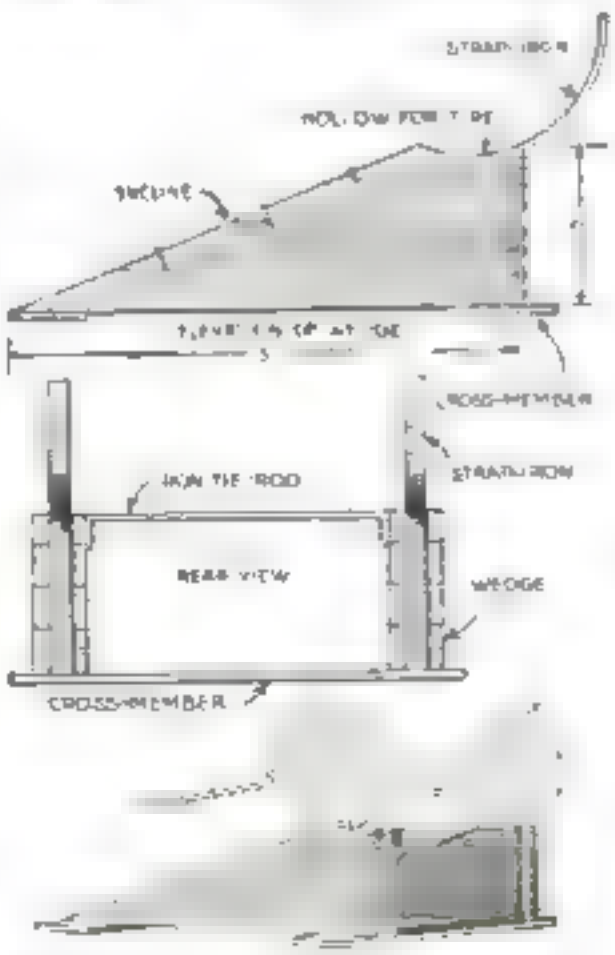


Where the wire has been held upon the potato a green spot will show. This denotes the positive pole of the battery

of the charging wires into a beaker of water in which has been stirred a teaspoonful of salt. Turn on the current and a discharge of fine bubbles will be seen to rise from the negative wire.

How to Work Under a Car Without a Pit

WHEN trouble occurs either with the under side of the automobile motor or the rear end of the car, it is somewhat inconvenient to work without a pit.



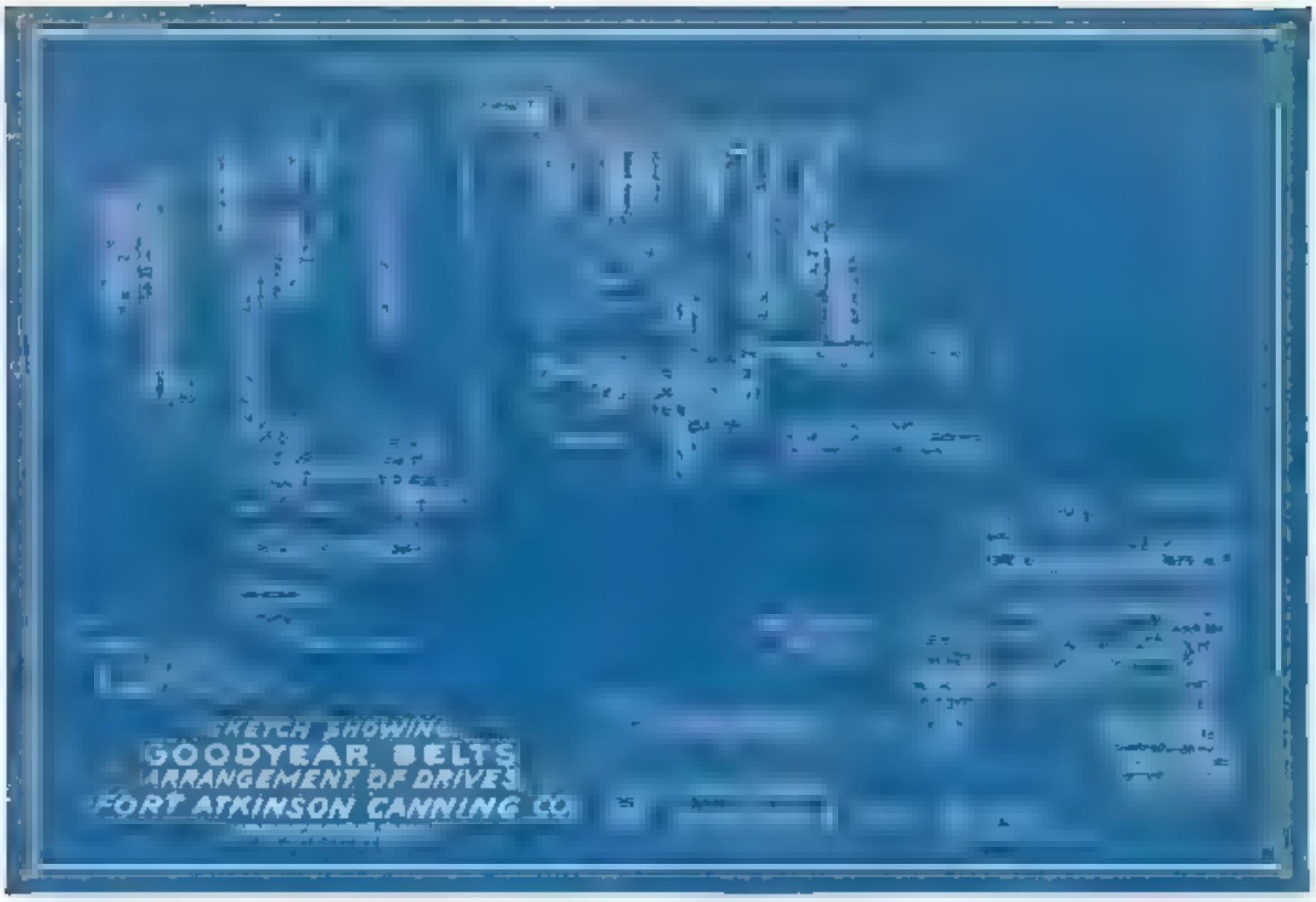
Run your car up the incline and work beneath it with ease. The contrivance is easily made and pays for itself in a short time

To partially overcome this condition a garage man built a sort of runway, as illustrated, by which the end of a car could be quickly elevated about two feet off the floor, thus allowing fairly easy access to the parts.

Two wedge shaped pieces were constructed of heavy spruce timber, 5 ft. long by 2 ft. high in the rear. The inclined ends of the timbers were fastened together by lag screws and the vertical backs secured to each other by a length of strap iron. The horizontal surface of the uppermost timber was hollowed out to receive the tire and the strap iron was continued outward in a corresponding curve which acted as a bumper to prevent the wheel running off the back of the support.

These two wedges were then bolted together at the bottom with two cross members, as shown, so they were just the width of the tread of a car

The car can be run up this incline either by power or by hand and the necessary work done with a minimum amount of inconvenience and labor. Of course it is not necessary to mention that it saves the repairman's back and nerves.—THORNTON HALLETT.



An Idea, Our Good Name—and the G.T.M.

They had never used a Goodyear Belt. Their experience with the belting they had in their parent plant had been generally satisfactory But the Fort Atkinson Canning Company did know Goodyear reputation for quality—knew it by the willing testimony and the demonstrated experience of other concerns the country over who were reporting notable successes with Goodyear Belts on every kind and condition of drive.

And the plant analysis idea proposed by the G.T.M.—Goodyear Technical Man—struck them as the logical way to insure the right belt for every duty They had opportunity to test the principle of it thoroughly in a study of their new plant's belting requirements. They had the G.T.M. make the study.

So they specified 100% Goodyear equipment—transmission belts, conveyor belts, steam hose, water hose—for their new cannery at Jefferson, Wis., all on the basis of the G. T. M.'s plant analysis, and their confidence in Goodyear products.

The Jefferson plant is an efficient linking of different transmissions and conveyors. No one type belt, however well adapted to one form of duty, could be depended on to fulfil with equal capacity all these varied demands. An expert analysis that insured the full effectiveness of every drive in relation to the entire unit appealed to the superintendent as the only right solution of the power problem.

Note the belts specified to their particular uses: for the light drives, where the conditions are small pulleys run at high speed and uniform load, Goodyear Glides; for general transmission and moderately heavy duty, Goodyear Kingtite has been used Width, plies and type are specified to the service required. The very natures of the Goodyear Belts employed meet the peculiarities of the situation. For instance, the belt on the canning conveyor, due to its particular construction of cover, fabric and friction, insures against the action of acids encountered in the raw material it carries.

The unfailing performance of these Goodyear Belts substantiates the plant analysis method of applying belts to the specific service. Their freedom from belt troubles—no slipping, no stretching to an appreciable amount, which usually causes an interruption in production in order to "cut out" and take up the slack—is their own best service assurance.

Both Goodyear analysis and Goodyear belts are at your service. The G. T. M.'s expert study of a single drive or a complete plant installation is without obligation on your part. For further information about the Goodyear plan of plant analysis and the G. T. M., write to the Mechanical Goods Dept. of the Goodyear Tire & Rubber Co., Akron, Ohio.

BELTING · PACKING · HOSE · VALVES

GOODYEAR

Pulleys on Posts Raise Wash Out of Way

WHEN there is a wash hanging on the back porch or in the yard, it is almost impossible for a person to pass without being slapped in the face by the wet clothes. The drawing shows a simple method of avoiding this discomfort. Two pulleys made of 8 in. wooden disks having bevelled

The elevated wash line isn't new by any means but it's a sure way of drying the wash quickly

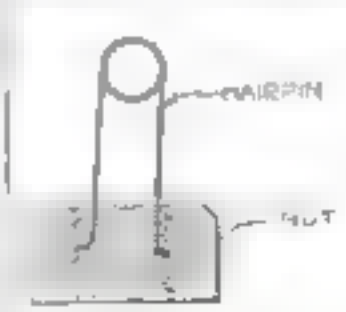
edges are bolted to each post used to support the wash line, one pulley at the top, and one about 3 ft. above the ground or floor. The bevelled edges of each disk are turned in when the pulley wheels are nailed together, leaving a grooved edge.

A ¾ in. rope is run over each pair of pulleys, the ends being spliced so that the rope fits the grooves of the pulleys tightly. The wash line is tied firmly to the pulley ropes on opposite posts, as shown in the sketch, so that when the pulley ropes are pulled up the wash line rises also.

By hanging the wash on the line when it is lowered, and then raising it, the whole wash is put up where it gets all the air, and where it is out of the way of anyone who wishes to walk under it. The posts should be from 12 to 14 ft. high to raise the wash the proper distance.—HORACE VAN NICE.

Using a Hairpin to Clean Machine Threads

A HAIRPIN is very useful in cleaning dirt and grit from screw threads of small diameter. It should first be bent into the shape indicated in the diagram so that the distance between the ends of the pin is slightly greater than the diameter of the threaded hole. Spring the ends of the pin together until they will go into the hole, then screw in the hairpin. The bent ends will remove all the dirt and grease from the threads. In cleaning very small threads it may be necessary to sharpen the ends of the hairpin.



Another of the many uses for the common hairpin is cleaning machine threads

United States SAND PAPER

In this automatic sanding machine are three drums covered with [illegible] and fine U. S. garnet paper

Fast-Cutting Mineral Abrasives

on Cloth and Paper

Flint Paper
Garnet Paper Garnet Cloth
Emery Paper Emery Cloth
Crocus Cloth
Carbalox Cloth
Herculundum Cloth

Sheets, Discs, Circles, Belts and Rolls of various widths and lengths of the above U. S. Abrasives.

In this small belt [illegible] metal [illegible] the pulleys and [illegible] on the other

Each speed emitter cloth belt [illegible] sand paper [illegible] in every [illegible] grind [illegible] U. S. sand belts are long

The old way of tearing sheets of emery into strips is wasteful. U. S. Emery, Carbalox and Herculundum in convenient rolls is the new and more economical way. Save time.

This map means dependable sand paper

SAND PAPER is NOT made with sand. Neither is all sand paper alike. Most assuredly, sand paper is a tool—a cutting tool—and is purchased with extreme care by all who demand the finest tools.

Sand paper, as made for many years by the United States Sand Paper Company, is fine white flint or semi-precious garnet, crushed and sifted through silk screens to minutely exact finenesses—then everlastingly glued to tough fibred paper made especially for the purpose, or strong cloth. Every step of the process is constantly subjected to searching inspection—for dirt or a few over-size grains in a fine polishing paper, for instance, would ruin the work. The glue must grip each grain just so—each little grain must be cemented to its neighbor just right—the flint or garnet grains must break and continually present fresh, sharp edges to the work. Exceptional quality that does not vary repays close attention to details like these.

In the wood-working industry, U. S. Sand Paper is used on drums, discs and sanding machines—each doing a tremendous amount of work formerly done by hand. Above the workmen's benches hang rolls of U. S. Sand Paper in several convenient widths and lengths—a wasteless, time-saving method of using sand paper.

For cutting metals, the tough, hard Herculundum and Carbalox from the fiery electric furnace are the modern fast-cutting artificial abrasives. Herculundum for cast iron and similar materials; Carbalox for steel, brass, copper, aluminum, etc. Discs of Herculundum cloth glued to wheels are taking an amazing amount of work from the planer and milling machine—and saving much time and money. We would welcome an opportunity to discuss this in detail with you. For machinists, we furnish Herculundum and Carbalox in convenient rolls. You can tear off from one of the rolls a piece of the exact width and length needed to do the work economically.

Buy U. S. Sand Paper scientifically—the right grade for each class of work. Our Service Department will help you determine if we have a grade of abrasive paper or cloth that will reduce your sanding costs—or turn out your metal, leather or composition products at less finishing cost. It costs nothing to get this information. Ever afterwards the U. S. map trade-mark will be your guide to dependable sand paper.

UNITED STATES SAND PAPER COMPANY, Williamsport, Pa.

Making a Hairpin Act as Photographer

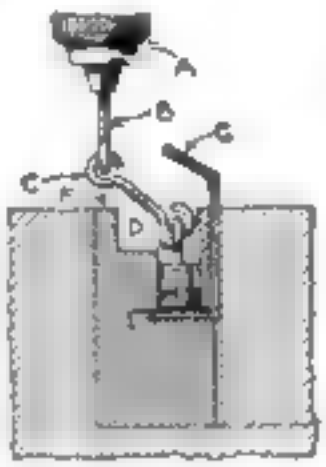
IT was during a picnic party. 'Twas a lovely day, and a gay crowd. The inevitable camera bug was there too.

Not to be left out of the last film, the photographer decided to use a hairpin to help him out. The camera was focussed on the crowd and a suitable place conscientiously reserved for the camera man. A hairpin was stuck into an apple so as to leave a hook by which the apple could be suspended. The camera shutter was set, and the apple hung upon the release lever, thus tending to trip the shutter by its weight. In order to give the photographer time to get back to the party another hairpin was hooked on to the lever so as to keep it up, this hairpin being attached to a long strip of wrapping paper reaching over the body of the camera and tied to the camera tripod.

The paper was then ignited, and the author ran to take his place. The paper burned through, permitted the apple to exert its weight upon the shutter lever through the intermediary of the hairpin and—the picture was taken.—ARTHUR WORISCHEK.

Can You Drill a Hole Around a Corner?

WHEN asked the above question, the tendency would be to answer in the negative; but look at the illustration accompanying this article and see how one of the readers of POPULAR SCIENCE MONTHLY actually accomplished the seemingly impossible feat.

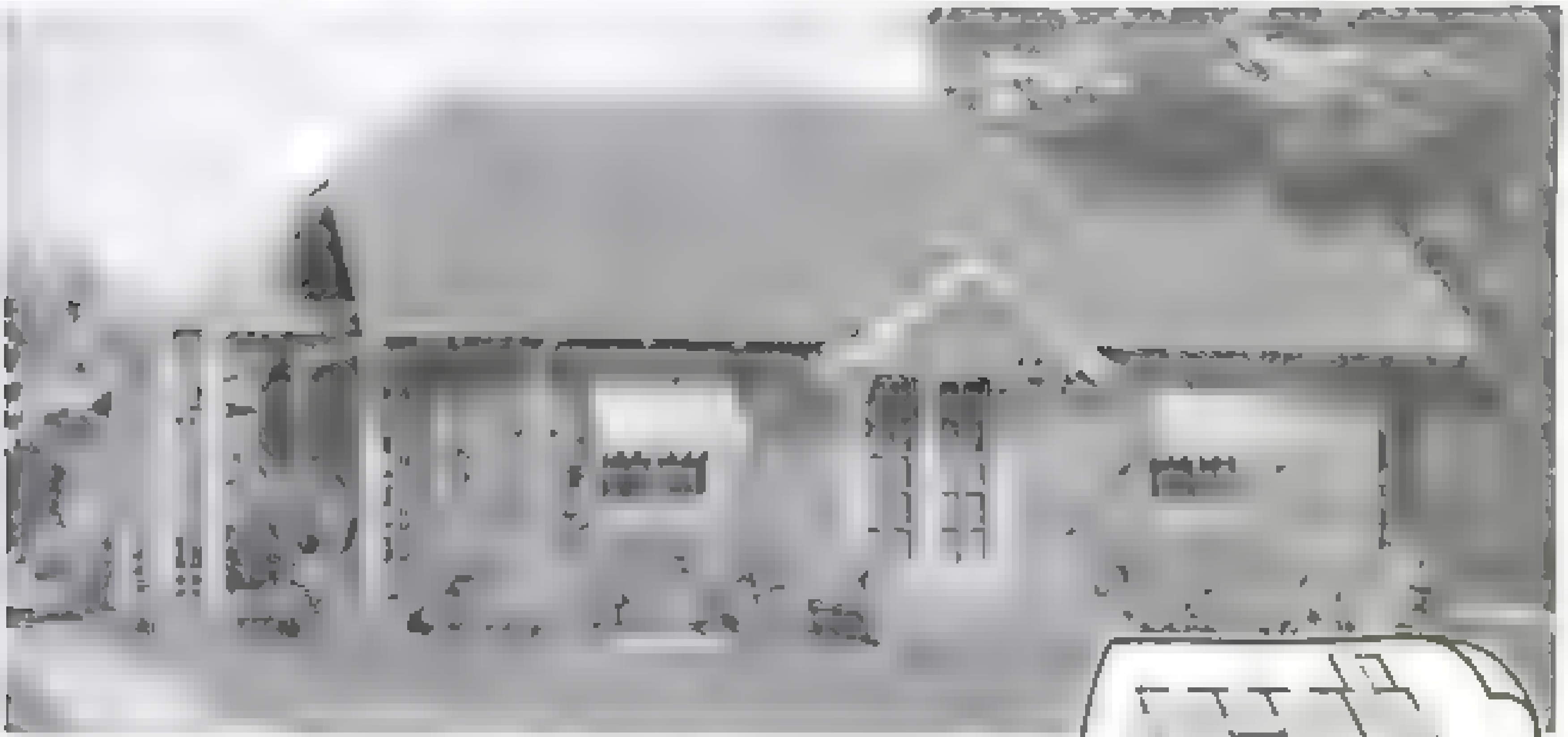


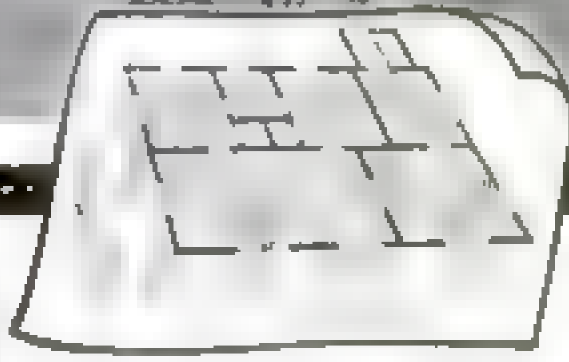
Drilling a hole around a corner is made possible by attaching three speedometer links to the bit and counterbore

It was necessary to counterbore the hole *E* and also face the bottom of the hole. A small counterbore of correct size, and three ordinary automobile speedometer chain links — *B*, *C*, and *D*—did the trick

Owing to the construction of the work to be counterbored, it was necessary to do this as the piece *G* could not be disassembled without a great amount of trouble. The link *B* was held in the ordinary drill chuck, the link *C* was merely a joining link, while the link *D* was cut off short as shown. This work was finished quickly by the use of this ingenius arrangement, and it is an idea well worth keeping in mind.—J. W MOORE.

Aladdin Homes





Reduce Present Building Cost

Save the Waste and Reduce the Cost [illegible] Aladdin System scientifically prepares the materials [illegible] on the cost of the lumber [illegible] [illegible] these statements. [illegible] an Aladdin Home near [illegible] established [illegible] advantages. **The Lumber that's Wasted Costs Just as Much as the Lumber that's Used.** [illegible] possible way to reduce present high prices [illegible] The Aladdin System prepares [illegible] ready [illegible] Waste of lumber [illegible] reduced to less than [illegible] Aladdin System. [illegible] Aladdin Homes [illegible] prospective builders [illegible]

Greatest Distributing System in the World

[illegible] Aladdin [illegible] be made from the [illegible] lumber producing [illegible] United States [illegible] Aladdin [illegible] Michigan, Mississippi, North Carolina and Oregon. [illegible] Aladdin houses [illegible] straight line [illegible] nearest timber region.

Aladdin's [illegible] Service means [illegible] freight rates for builders [illegible]

Complete Sales and Business Offices are maintained in connection with each mill. [illegible] time is saved in your mail reaching our offices.

Dollar-a-Knot Guarantee

Aladdin's Dollar-a-Knot [illegible] Aladdin homes [illegible] Aladdin home. [illegible]

Price Includes All Material

The Aladdin Book of Homes [illegible] Aladdin Homes [illegible]

Aladdin Readi-Cut Homes

[illegible] Aladdin Homes shown in the Aladdin [illegible] page book have a charm for everyone desiring a home. Bungalows of [illegible] rooms, [illegible] are well represented in [illegible] Dwellings of one and two stories [illegible] the desires of every builder. [illegible] colors. [illegible] made direct from actual photographs of each Aladdin Home as it is now built and occupied in many parts of the country [illegible] the most popular designs of homes today. There is an important message for every homebuilder in this book. It points the way to a better home at reduced cost. It helps you to avoid present high building prices. Send for a copy today.

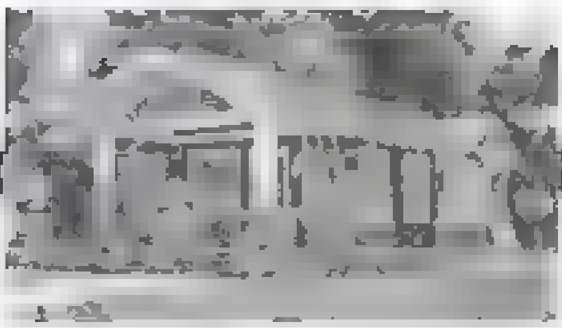
20 ft. of Lumber From a 16-ft. Board

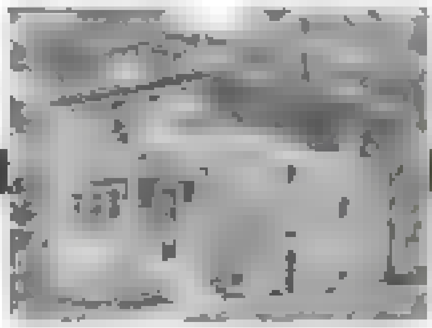
The Aladdin System of Homebuilding has been [illegible] Aladdin Book [illegible] lumber [illegible]

The Aladdin Co. Bay City Michigan

Branches: Wilmington, North Carolina · Hattiesburg, Mississippi · Portland, Oregon · Toronto, Ontario, Canada

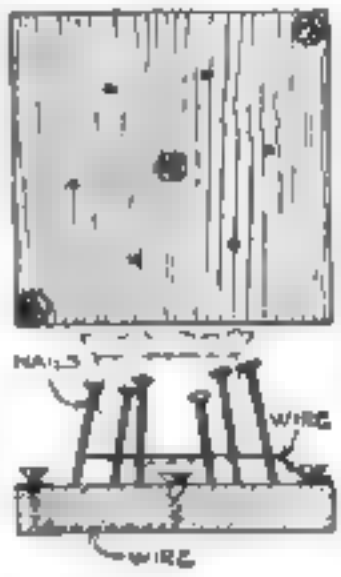
Write to Nearest Offices





How to Make a Small Battery Socket

WHEN you want to put up a small battery lamp and can't find a socket, here's the way to make one in a hurry



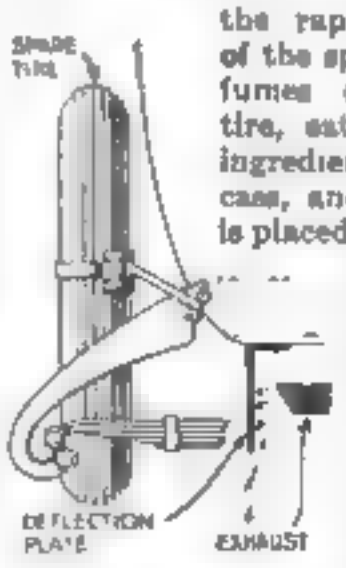
Making a miniature bulb socket in a hurry is sometimes necessary. Here's a way to do it easily and quickly with the simplest materials

Use a piece of soft wood about three inches square for a base. Then drive five or six small wire nails with wide heads in the center of this base and incline them towards each other so they will form a section of a cone—that is, driven in a circular position with their heads nearer together than the bottoms.

Also see that the head of each nail is a trifle higher than the one preceding it so if a line were laid around them it would form a rising spiral. Make this spiral go in the same direction as the threads of the lamp base and of a size to fit it. Then drive a larger nail or screw in the exact center of the base. Connect it to one screw and washer on the top of base for one contact and bind with a wire around the nails and connect it to a second screw and washer for the other.

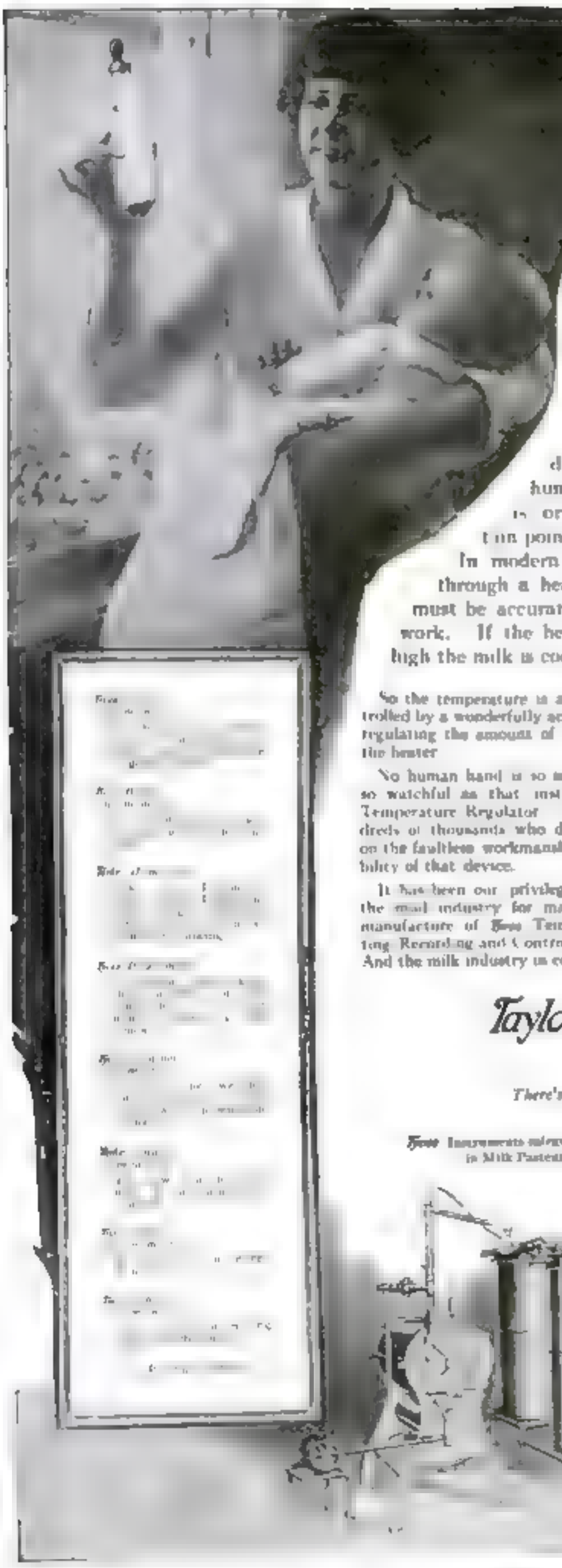
Protecting the Spare Tire From Exhaust Gases

THE poisonous gases that issue from the exhaust of an automobile very often cause the rapid deterioration of the spare tire. These fumes eat away the live ingredients of the carcass, and when the tire is placed upon the wheel, the rotten fabric explodes with a loud "plop"



How the fumes from the exhaust of a car can be deflected so they will not injure the spare tire

A piece of sheet iron bent and attached to the rear of the car, as illustrated, will deflect the exhaust and thus prevent the gases from injuring the tire. Just for curiosity's sake watch the cars as they go by and note how many of them throw the exhaust fumes into the spare tire. You will be surprised.—PAUL FETHERSTON.



Conserving Life by Temperature Control

THOUSANDS of babies died of "summer complaint" or "inflammation of the bowels" last year

They died because the cow's milk fed them was swarming with deadly germs. And before Pasteur discovered that bacteria are deadlier than bullets hundreds died where one dies today. That is why milk is or always should be pasteurized—heated up to a certain point

In modern sanitary dairies thousands of gallons of milk go through a heater. The temperature to which the milk is heated must be accurately known and *maintained* There must be no guess work. If the heat is too low the germs are not killed. If it is too high the milk is cooked, hard to digest

So the temperature is automatically controlled by a wonderfully accurate instrument regulating the amount of steam supplied to the heater

No human hand is so sensitive, no brain so watchful as that instrument—the Tycos Temperature Regulator The lives of hundreds of thousands who drink milk depend on the faultless workmanship, on the infallibility of that device.

It has been our privilege to have served the [illegible] industry for many years in the manufacture of Tycos Temperature, Indicating Recording and Controlling Instruments. And the milk industry in common with hundreds of other industries use Tycos instruments because of their *dependable accuracy*.

There are over 4,000 different types and styles of instruments in the Tycos line, ranging from the delicate fever thermometer for taking body temperature to the Fery Pyrometer, accurately recording thousandths of degrees of heat. At the left we list Tycos instruments for the home. Ask your dealer about them. If he won't supply you, write to us direct sending dealer's name. Literature concerning any instrument or types of instruments in which you may be interested will be sent you on request

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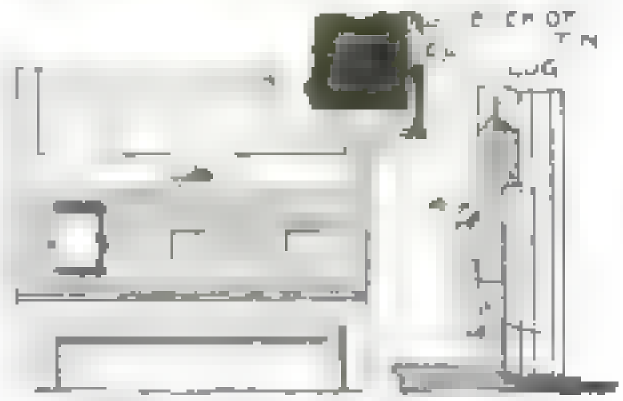
There's a Tycos or Taylor Thermometer for every purpose.

Tycos Instruments safeguarding health in Milk Pasteurization

A Window Ventilator that Can Be Regulated

An easily constructed and inexpensive window ventilator can be made from three tobacco tins and a board.

The board 8 in. high is cut so as to fit across the window frame closely. Three rectangular holes, 2¼ in. long by 2 in. high, are cut in the board. Openings of the same dimension as the holes in the board are cut in the



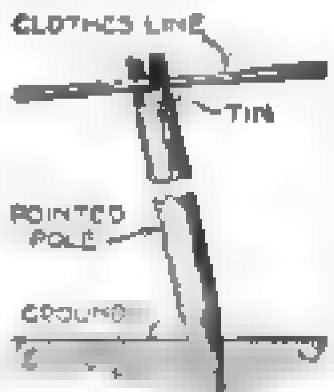
Make your own window ventilators from a board and old tobacco cans. They work to perfection

backs of the tobacco tins, with lugs bent outward and fastened to the board at the three openings.

At the left of the illustration is shown the board with one can attached: at the right, the direction of the air currents. The covers are left on the cans so that one or all of the openings can be closed at any time.—James Carroll.

To Make the Pole Stick to the Clothes-Line

How many times have you watched the clothes-pole, accelerated by the wind, slide down the line and drop the newly washed clothes into the mud? Many times we will warrant, but here's a way to eliminate that trouble.



Clothes poles can't blow from the line if fitted with a tin clip and sharpened at the lower end

Use the ordinary 7 ft. pole that has a notch cut in one end. Whittle the opposite end to a sharp point and procure a piece of tin, of medium thickness measuring ⅝ of an in. wide and 10 in. long, bent to the shape shown in the illustration.

Attach this to the unsharpened end of the pole with small wire nails. The result will be that the sharpened end of the pole sticks into the ground and prevents it slipping, while the tin clip on the top end through which the clothes-line passes, makes it impossible for the wind to knock the pole from the line.—G. F. Collins.

Stop the costly delays *with* DAYLO

Every machine hour lost reduces your bank balance!

For Machinists: Daylo is a handy necessity at every planer, lathe, boring machine and drill press—it looks into the insides of the job—under the machine—nothing can hide in crevice, cranny, or nook. Unattached to fastenings or wires, Daylo looks everywhere.

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For Woodworkers, Textile Hands and Everybody Working amid Inflammable Materials: Daylo is as handy as a screwdriver. Its great utility and absolute safety make it indispensable in a field entirely its own.

There is a DAYLO to solve your difficulties—one of the many different styles of light that point the way to efficiency. All leading electrical, hardware, drug, sporting goods and auto-accessory jobbers and dealers carry Daylo. Or write us.

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Automobile Drivers, Good, Bad, and Indifferent

A GOOD driver is a born driver. He possesses intuition that can never be acquired; it is almost an extra sense. He is born with a keen sense of sound, so that he knows the purr of his engine, and the slightest variation will strike him at once. In judging distances his eye is almost perfect, and he never makes a mistake when selecting a gap in traffic. He hardly ever touches the brakes, and all motion is smooth. To such a driver it is not necessary to run up to a traffic block, apply his brakes hard, then take the gap with a sliding skid. He sees the block and judges the distance so that the way will be clear, eases off the throttle, and, when the gap appears, slides into it without using the brakes at all, without a change of speed or the tensing of nerves by the other occupants of the car.

Another sense that is well developed is that of touch. It is no trouble for a born driver to start his car with a gliding motion instead of with a jerk, to pull up quickly in case of emergency without jar or jerk, or to restart the car when standing on a steep hill, accelerating the engine just enough to take the load at the moment he feels the clutch take hold, removing

Most automobile accidents result from pure carelessness. Avoid them by obeying the traffic regulation

the brakes. In appearance it is very easy, simple, and finished, but just how many drivers can do it? The next time you are out on the road watch this good driver and note why he maintains a constant speed. Find your car's driving speed and stick to it. More gasoline is used when you accelerate quickly, and it should not be done more often than necessary. Economy, like temperance, is moderation.

Marking the Indifferent Driver

The indifferent driver is he who drives safely, but without sympathy for his car. He never does anything very wrong, nor does he do anything very well. True economy in driving results from such things as proper spark control, turning corners properly, right timing and gear changing. He should cultivate the habit of coasting around corners or changing into second speed. Turning corners at speed imposes intense strain on all

Blue Buckle Union Made OverAlls

Your money buys more quality, more comfort and service in Blue Buckle Over Alls and Coats than in any work garments you ever put on. An actual wear test will prove that from the finest Union workmanship down to the smallest detail every care has been taken to make Blue Buckles unequalled in service and satisfaction.

It's a fact that among men who do the world's great industrial and farm tasks, and home-chore men, Blue Buckles are making new records for handing out the biggest value ever put into a work-rig!

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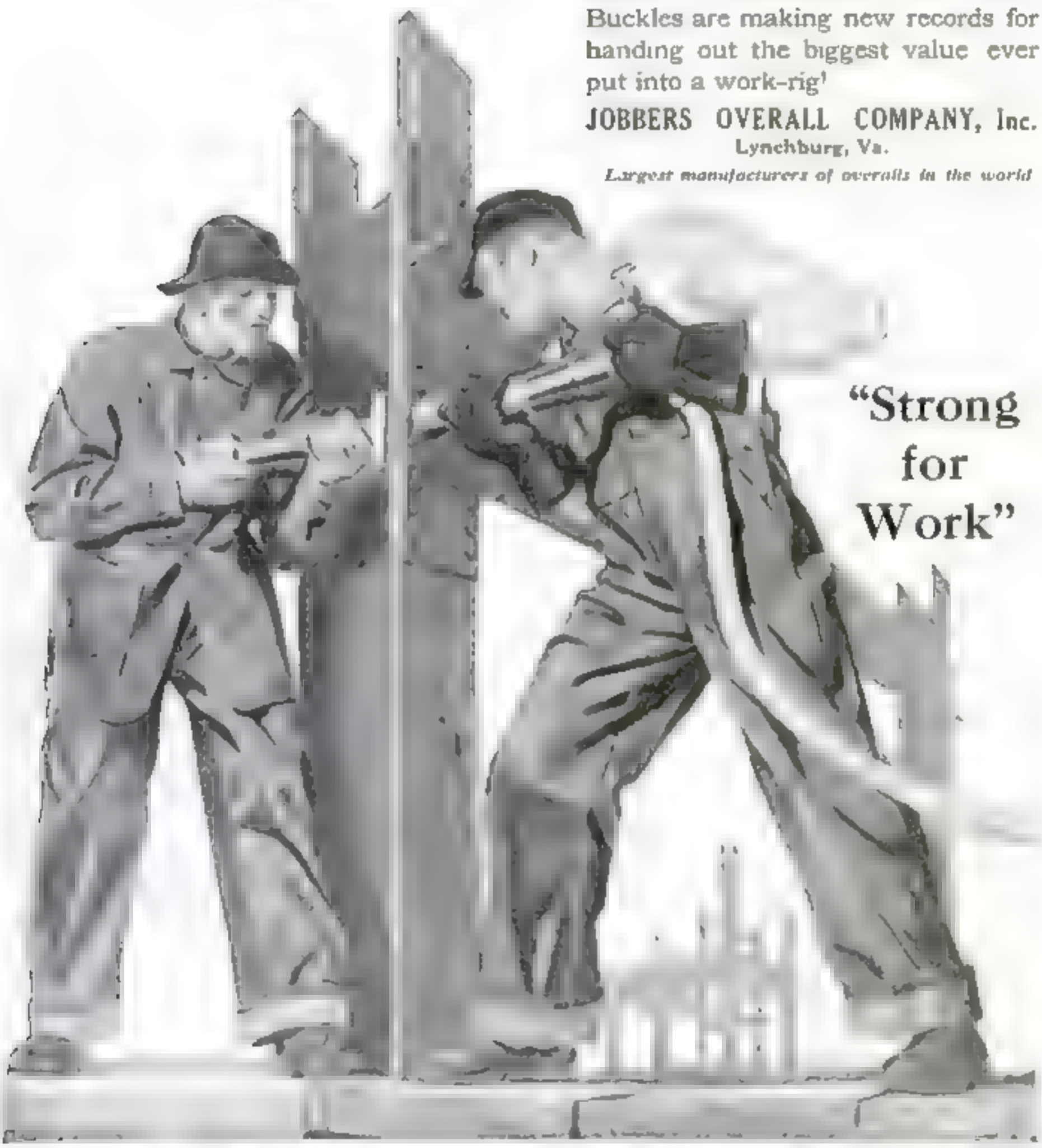


"Strong for Work"

parts of the mechanism and should be avoided. It is also bad for the tires.

The car that is badly treated is always calling for attention, and its language is easily understood if one will pay attention and understand it, and if its talk is interpreted in time many dollars can be saved that would otherwise be spent in expensive repairs.

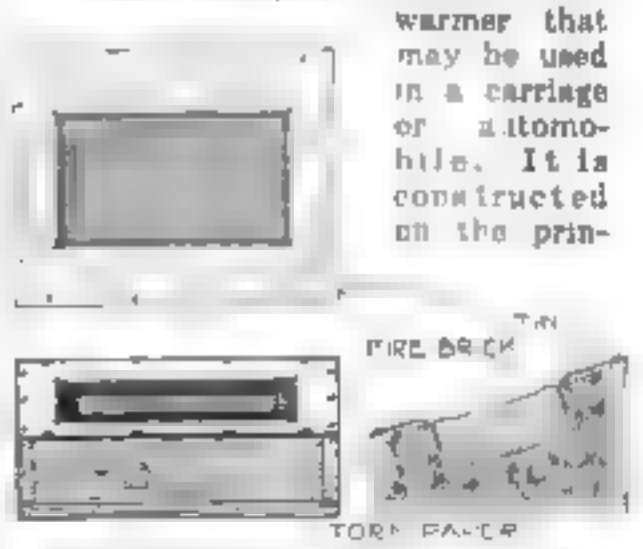
Who Wants to Be a Bad Driver?

And lastly comes the bad driver. He is selfishness and ignorance personified, and his name is legion. He thinks he knows it all, yet he is brutal to his car, overdriving the engine downhill, whipping it uphill, speeding over rough roads, and caring nothing for the safety or feelings of other motorists.

He is the type that always does the wrong thing in an emergency, because he lacks imagination. He wears out the road and every machine he touches in a short time. If something isn't done to this class of driver, he eventually lands in the hospital. Only heaven knows what he will do. If you are like him, beware and change your ways before it is too late. Of all contemptible things, the Road Hog is the worst.

Foot-Warmer Made from a Fire-Brick and a Box

THE accompanying illustration shows a simple but efficient foot-warmer that may be used in a carriage or automobile. It is constructed on the principle of the fireless cooker. A brick is used as the carrier of the heat, and torn paper as the non-conducting material between the metal brick-container and the sides of the box.



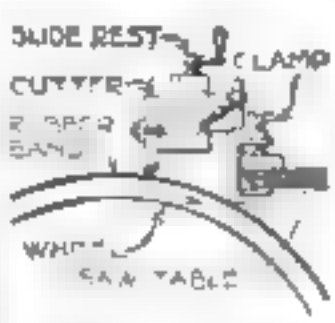
The old-fashioned fire-brick now does duty for automobilists on zero days

To make one, simply take an old box about 12 in. long, 8 in. wide, and 6 in. deep. Take a piece of sheet metal, and cut and fit to it the size of a large fire-brick, leaving enough metal so that when the form is set in the center of the box the edges of the metal will come to the edge of the box, as shown in the sketch.

Fill the space underneath and around the metal with torn paper, and nail the metal to the box.—HARVEY MEAD.

To True Up Irregular Band-Saw Rubbers

A GREAT many broken band-saws may be traced to lack of concentricity in the wheels of the machine. A rubber band about ¼ in. thick is glued to the periphery of the upper and lower wheels. If this band were always of an exact thickness and perfectly set, its outer surface would run true provided the wheels themselves are true. First the main bearings should be examined and any looseness taken up, then the wheels should be tested and if found "out of true" they should be turned in a lathe. After that the rubber assumes the responsibility and frequent breakage can be traced to its inaccuracy.



With this contrivance, it is possible to true the most irregular rubber band in two hours

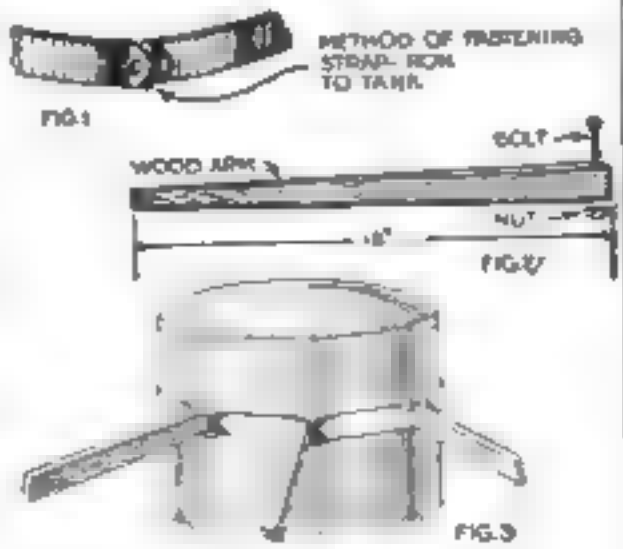
The illustration shows a "set up" for truing rubbers right on the machine. This is the best way to do the work if it is at all possible. A small slide rest is set up on the table of the machine and clamped in such a position that the travel of the tool turns a straight cut on the wheel. *C* clamps are used to attach the angle plates on the table and to hold the slide rest to them. If it is possible to slow down the speed of the wheel, the tool will last much longer between grindings. If not, it will have to be sharpened after each cut, for rubber wears a too very fast.—DONALD A. HAMPSON.

The Kitchen Hot Water Tank as a Drying Rack

A SIMPLE drying rack for the kitchen hot water heater was made in the following way

A length of strap iron, long enough to reach around the tank, was procured and at intervals of 8 in. the edges were bent outward towards each other at right angles to the surface of the strap iron. These were then bored with small bolts and the iron placed about the tank and fastened as shown in Fig. 1.

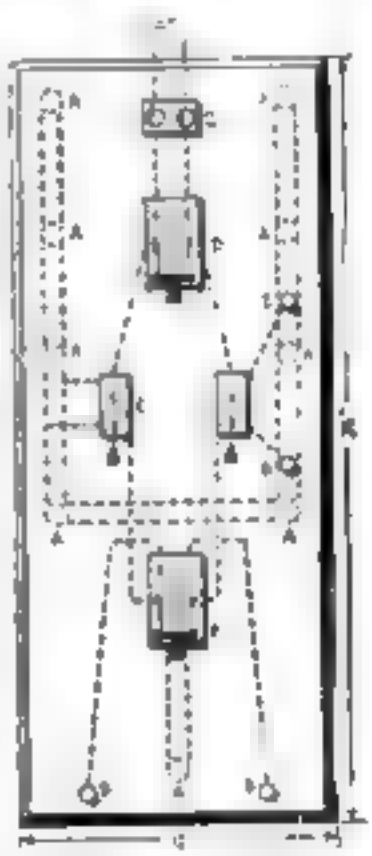
Then arms cut from a fir board were shaped like the one in Fig. 2, and bored at the thick end. They were then fitted into place and made to swing freely. Fig. 3 shows the completed rack.—DALE VAN HORN.



Here the kitchen hot water tank serves a double purpose by the attachment of a drying rack to its top

A Testing and Outlet Switchboard

IN the amateur's electrical den and the shop of the small electrical contractor or repairman, standard lighting current is often needed at an outlet and under a means of control without the disadvantages and inconvenience entailed by the usual plug-and-cord connection to a lamp-socket. To meet this need the switchboard here illustrated has been designed and constructed, at small cost, from standard wiring fittings.



This type of testing switchboard supplies either alternating or direct current from terminal binding posts

The board proper is of pine ⅞ in. thick, 12 in. wide, and 36 in. long. Its front surface is planed smooth, and the edges and corners beveled. Across each end cleats 2 by 2 in. support it clear of the wall, to which it is fastened by means of ⅜ by 5 in. lag-screws at each corner.

All fittings are mounted on its front surface and all wiring on its back, the wire used being standard No. 14 gage rubber-covered copper. This is supported on cleats and knobs clear of both board and wall, while, where it passes through the board to make connections, it is carried through an insulated covering; this is necessary also wherever two wires that do not connect chance to intersect.

The leads from the standard 110-volt supply circuit are carried first to the fuse-block *C*, which may be of either the plug or the cartridge type.

From there they are carried to the 15-ampere, double-pole, single-throw knife-switch *D*, which is the master switch that cuts off the entire current supply. From this switch each wire is carried to one of the 15-ampere, single-pole, single-throw switches *E* and *E*, which connect respectively with the cleat receptacles *A* and the pair of upper terminal posts *B* and *B*.

From these switches the wires go to the center connections of the 15-ampere, double-pole, double-throw knife-switch *F*, the upper and lower connections of which go to the bottom cleat receptacle *A* and the pair of lower terminal posts *B* and *B*.

Flexible and Safe Arrangement

The result is an arrangement that is flexible and at the same time simple and safe.

The fuse-block *C* can be fitted with fuses of a proper size to afford a working margin of practical safety for the apparatus which is being supplied through the board.

By closing both of the single-pole switches *E* and *E*, current can be drawn from either the lower terminal posts *B* and *B*, or the bottom receptacle *A* at the full 110-volt tension. If it is desired to introduce resistance into the circuit, lamps may be screwed into the receptacle *A* and the switch *E* opened, thus forcing the current through the lamps. If more resistance is desired, a grid or rheostat can be connected across the upper terminal posts *B* and *B* and the other switch, *E*, opened. By varying the number of lamps inserted and the character of the resistance or reactance, the voltage and current may thus be varied through a wide range.

One of the uses to which the switchboard is particularly adapted is the testing of lamp-socket devices. A flatiron, fan, or small motor suspected of defect can be plugged into the lower receptacle *A*, a lamp screwed into one of the side receptacles *A*, and the switch *E* opened. Then if, when the master switch *D* is closed, the lamp burns too brightly, there is a short circuit in the device. This fact can thus be determined without the blowing of a fuse or an elaborate galvanometer or telephone test.

Another advantage of the board is its convenience in supplying current from terminal binding-posts. When a motor or other device that is not fitted with an attachment plug connection is to be operated, trouble is often experienced in making a connection to a supply circuit where only lamp-sockets are to be had. The posts make the current available. In addition it is controlled by a proper switch and protected by a fuse.

Strips of slate, hard fiber, or other moisture-resisting material should be used to support the binding-posts *B*. This will prevent a possible short circuit through the wood of the board in case of accidental wetting.

In constructing the board the fittings should first be mounted on its front, wiring put on its back, and then the whole hung in position, when it will be ready for service as soon as the supply leads are connected.

The entire cost of the switchboard should not exceed two or three dollars. It can be used with either direct or alternating current. —C. M. ADAMS.

"He Deposits $500 a Month!"

"See that man at the Receiving Teller's window? That's Billy King, Manager for Browning Company. Every month he comes in and deposits $500. I've been watching Billy for a long time—take almost as much interest in him as I do in my own boy.

"Three years ago he started at Browning's at $15 a week. Married, had one child, couldn't save a cent. One day he came in here desperate—wanted to borrow a hundred dollars—wife was sick.

"I said, 'Billy, I'm going to give you something worth more than a loan—some good advice—and if you'll follow it I'll let you have the hundred, too. You don't want to work for $15 a week all your life, do you?' Of course he didn't. 'Well,' I said, 'there's a way to climb out of your job to something better. Take up a course with the International Correspondence Schools in the work you want to advance in, and put in some of your evenings getting special training. The Schools will do wonders for you—I know, we've got several I. C. S. boys right here in the bank.'

"That very night Billy wrote to Scranton and a few days later he had started studying at home. Why, in a few months he had doubled his salary! Next thing I knew he was put in charge of his department, and two months ago they made him Manager. And he's making real money. Owns his own home, has quite a little property beside, and he's a regular at that window every month. It just shows what a man can do in a little spare time."

Employers are begging for men with ambition, men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of a man! The International Correspondence Schools are ready and anxious to help you prepare for something better if you'll simply give them the chance. More than two million men and women in the last 28 years have taken the I. C. S. route to more money. Over 100,000 others are getting ready in the same way right now.

Is there any reason why you should let others climb over you when you have the same chance they have? Surely the least you can do is to find out just what there is in this proposition for you. Here is all we ask: Without cost, without obligating yourself in any way, simply mark and mail this coupon.

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Make Your Lamp-Socket Yield Current at Will

By John D. Adams

This article, and several others by Mr. Adams which are to follow, will shortly be republished by the POPULAR SCIENCE MONTHLY *under the title "Experiments with 100-Volt Alternating Current." It will be a book of much value to amateurs and students generally.*—EDITOR.

IF a switch with contacts at each side were connected to the alternating-current mains as indicated in Fig. 1, direct current could be secured provided it were physically possible to throw the switch from one side to the other one hundred and twenty times a second. A mechanical rectifier, so called to distinguish it from an electrolytic or mercury rectifier, is virtually such a switch so arranged that the alternating current operates it at the desired speed.

Not infrequently in experimental work one requires direct current, and

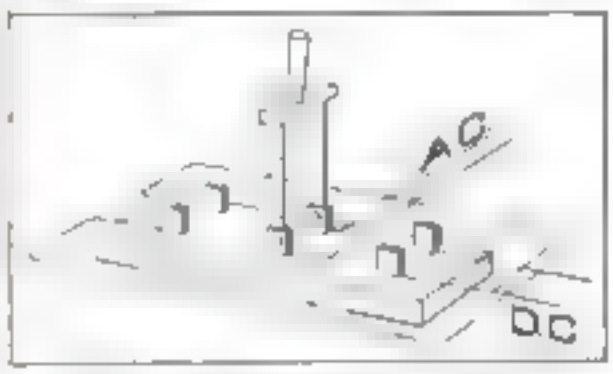


Fig. 1—Throwing this hand-switch back and forth 120 times per second, would rectify 60-cycle current

the rectifier illustrated in Fig. 2 enables one to secure it at 110 volts, or even at a lower voltage, such as is produced by a small transformer. The resulting efficiency will depend, of course, largely on the accuracy of workmanship, but theoretically the principle involved may be made to yield very satisfactory results.

The device consists essentially of a pointed electromagnet, in front of which two insulated steel springs are mounted and tuned to vibrate at the rate of one hundred and twenty per second. Each spring moves between two adjustable screw points, cross-connected as shown. A moment's study will make it apparent that we now have in effect a reversing switch that keeps step with the alternations of the current, and that if the two line wires are connected to the two springs, direct current will be available at the screw points.

If the operating coil had little or no self induction and the weight of the spring were negligible, it would cross the center line at the instant the current in the line is at zero and no sparking should occur as the current was switched from one side to the other, but in actual practice all these factors play a part. It is possible, however, to arrange the device so that

very little sparking will occur by having the contacts broad and properly adjusted, and sometimes the placing of a reactance coil in the main line will result in shifting the phase to a more desirable point.

In the illustration the supports for the adjustable contact screws are omitted for clearness, but in Fig. 3 will be found a suggestion for disposing of this feature. A pair of brass blocks is provided for each side, and, after being insulated in the manner shown, they are clamped to the base with one screw. The threaded holes for the adjusting screws should be slotted and sprung together slightly so as to hold the screws firmly in any position. The connections may be soldered directly to the blocks, or the wires can be clamped with screws as in a binding-post.

There is little that can be presented in the way of dimensions, as everything essential depends on the size and nature of the vibrating springs. Those used by the writer were 3/16 in. wide and about 1/64 in. thick. The total overhanging length was 2½ in. with the contact screws placed at the midpoints.

Procure two pieces of spring steel

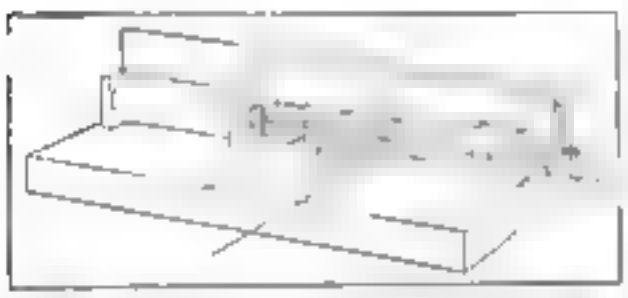


Fig. 3—Here is an electrical interrupter which will do the work of Fig. 1 more easily

about this width and thickness, and solder to the end of each a piece of 3/16 in. round iron ½ in. long. Clamp three springs near the free end with a single screw, and between two pieces of hard rubber or fiber—leaving a space of about 3/16 in. between the springs. The fiber prevents the springs from touching and causes them to vibrate as a single piece, all of which is very essential.

The base should now be made ready, and a hardwood block firmly screwed to one end to support the vibrators, which are held in place by clamping them to the block with a piece of fiber held down with a wood screw in the center.

The process of tuning may now commence, and in this no little patience will be required to secure the proper rate. First clamp the springs with about an inch projecting, place the magnet to one side and at right angles, and find the most effective length, which will represent a rate of two hundred and forty. Multiply this by 1.414, and clamp the springs at the distance so determined, and tune again.

The new point will be for the desired rate of one hundred and twenty. When the adjusting screws, however, are placed in position it will

be found necessary to increase this length, as the greater part of the vibration occurs between the screws and the free end. Increase the length slowly step by step, giving the springs a brisk start at each trial. When the proper point is reached there will be no doubt about it, as the vibration will continue with surprising activity when once started.

When the preliminary trials are finished, assemble the various parts permanently, clamping the coil to the base in a manner that will permit of its being moved back and forth longitudinally. Adjust the screws to within a hundredth of an inch of the springs, after which the device may be tested. At first place a bank of two or three lamps on the alternating current side, and then connect up a single lamp on the direct current side, which should be found to burn rather dimly but steadily. To be sure that direct current is being actually obtained, remove the single lamp and dip the two wires in a glass of salty water, and if the current is direct a steam of bubbles should arise from one of the wires—that is, the negative one.

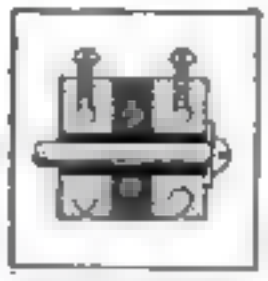


Fig. 3—Support for adjustable contact screws

Another interesting experiment in this connection is illustrated in Fig. 4. Here we have a straight steel spring tuned to make one hundred and twenty vibrations per second. A very thin strip of brass or copper is placed alongside of this, and both are clamped in a horizontal position to a suitable post.

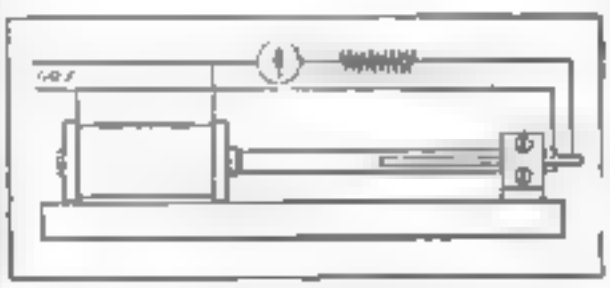


Fig. 4—A rectifier which uses but half of the alternations, gives pulsating current

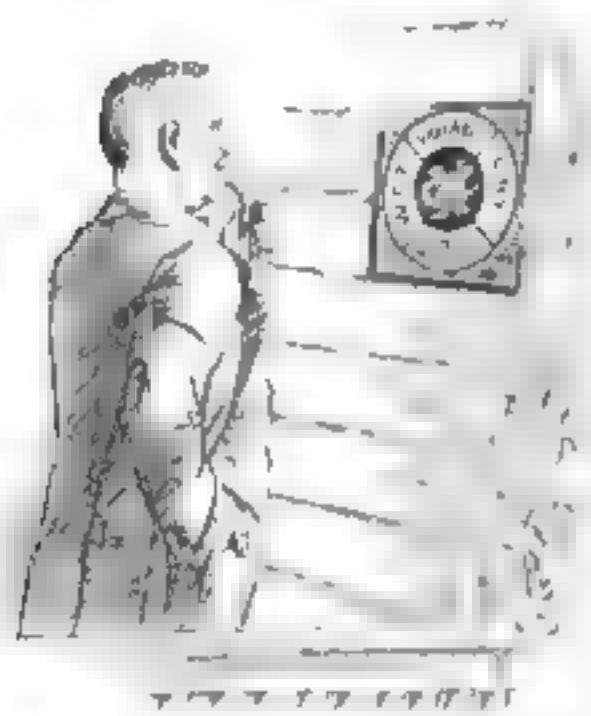
The small strip is insulated from the spring, however, by placing a piece of card or heavy paper between them before clamping. When the steel spring is at rest the strip should be as close as possible without actually touching.

Connect up as indicated, placing one or two lamps in circuit and also a galvanometer. When the spring is finally set in vibration by the coil to the left, it is evident that a contact will be made between the spring and the thin strip sixty times a second, and as the line current makes a completer cycle in one sixtieth of a second, the current, though intermittent, will flow in the same direction at each contact, as will be proved by the deflection of the galvanometer

The Chameleon Barometer Predicts the Weather

ONE of the most novel weather tellers is that known as the chameleon barometer. It is a very reliable device for indicating coming changes in the weather, and is very easy to make.

Obtain a piece of stout cardboard. If it is round the effect is all the better Right in the center paint a dead black circle on which the chameleon will later be mounted. Divide the white ring surrounding it into four equal parts. These are marked Wet, Variable and Dry. The lower space is lettered Chameleon Barometer



You can make a weather prophet whose predictions are always sure to come true

Now color the Wet space pink, the Variable section purple and the Dry space blue. These give indications of the color that the chameleon will take on according to the conditions of the weather at that time

The chameleon should be made from good blotting paper. Sketch out the animal with a pencil, making a strong outline, and indicating the leading characteristics. Then cut out the picture and soak it in the following solution: Cobalt chloride, 1 part, gelatin, 10 parts; water, 100 parts.

When the picture has been thoroughly saturated fix it with strong glue on the black area in the center of the cardboard

Mr. Chameleon will then play the part of a weather prophet, changing color in relation to the humidity of the air, and you'll find that he predicts more truly than the human prophet.—S. LEONARD BASTIN.

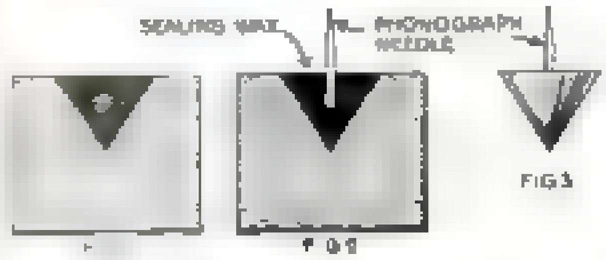
Phonograph Needles Make Excellent Push-Pins

HOME-MADE push-pins are just as good as those you buy and even better, for they can be made in a variety of colors.

As nearly every home is fitted with a phonograph you probably have an

abundance of used needles which you have heretofore thrown away

Procure some sealing wax in different colors and a block of wood for the



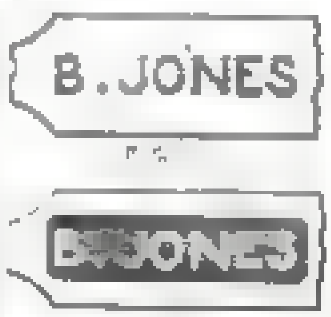
Push-pins are available about the house To make them in various colors is a new and useful idea

mold. Fig. 1 shows how the block of wood is cut to form the mold. Of course the mold may be made in any form to suit the individual fancy. Melt the sealing wax over a candle until it is even with the top of the mold, let it begin to harden, then thrust the needle into the wax, as shown in Fig. 2, and hold the needle in position until the wax hardens. When it is cold, knock the bottom of the mold upon a hard surface and the finished push-pin will come out easily. This is shown in Fig. 3.

If the mold is well oiled, the pins will emerge more easily than otherwise.—Arthur Goldenbaum.

Marking Tools for Purposes of Identification

IT is convenient to know your own tools when you see them; yet if they are not marked with your name or initials they are often very difficult to identify. The best place to set your name is on the steel portion of the tool where it is exceedingly difficult to remove it. This process is called etching. With a small brush cover the tool surface to be etched with beeswax that has been melted. If the wax hardens before the surface can be covered, warm the tool slightly. Then, with a knife or other sharp instrument scratch your name on the tool



Etch your name on your tools. Then if they are lost or stolen you can easily identify them

The etching liquid is compounded as follows

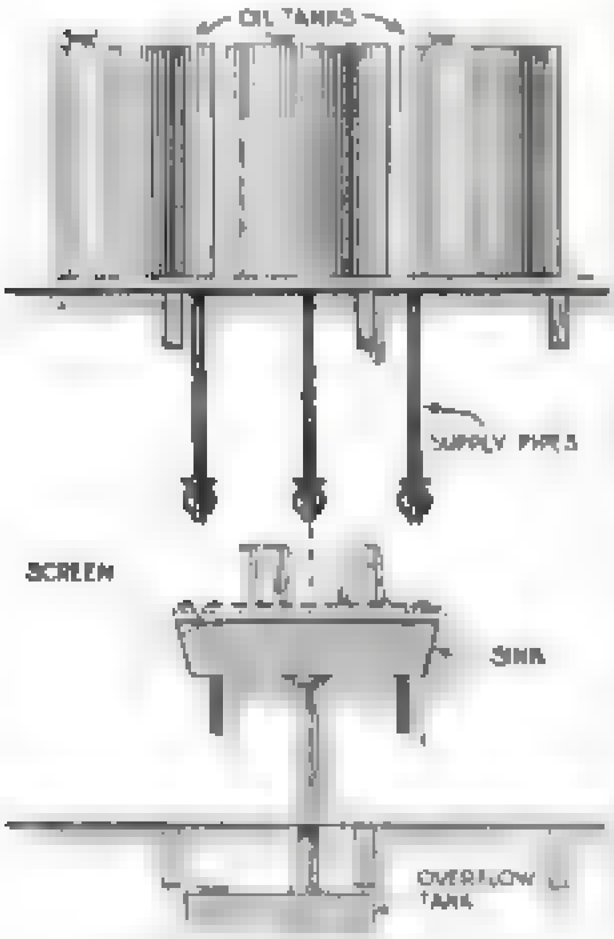
Iron or steel	Nitric acid	1 part
	Water	8 parts
Brass or copper	Nitric acid	1 part
	Muriatic acid	1 part
Aluminum	Acetic acid	3 parts
	Alcohol	2 parts
	Antimony chloride	2 parts
	Water	15 parts

Hard steel will require a stronger solution than soft steel; therefore if it does not etch fast enough add more nitric acid.—Harold F. Neff.

An Improvised Oil-tank Arrangement

EVERY garage owner has to contend with a shrinkage in his lubricating oil which is always attempting to make inroads in his profits. This is largely due to waste and loss in handling. A few drops here and there as it is being transferred from the supply tank to the customer's car, now and then a loss of a pint or so as the faucet is left open too long and the measure overflows—this is how losses are apt to occur.

By using the arrangement shown in the illustration the loss is entirely eliminated. The measures are placed on a piece of heavy, coarse-meshed screen, covering the old sink, over which they are filled and turned upside down when not in use. If the faucet is left open by mistake the oil will simply drain down into the tank below.



The oil waste in a garage will be reduced to a minimum if this oiling system is adopted

The economizer can be made with but a slight outlay for labor and material, and will prove a great money-saver.—PAUL L. FETHERSTON.

Tires Wear Better in Winter than in Summer

HEAT is one of the worst enemies a tire is called upon to face, especially friction heat. The winter air lessens this heat and makes it possible for a tire to last longer in spite of the extra pounding it gets when snow and ice are on the ground.

This rule applies, of course, where the tire is confronted only with the ordinary bad roads conditions arising from frozen highways. But where the motorist must drive his car over rough roads deeply cut with ruts, only the most careful driving will give him a full return on tire investment.

Put This in Your Pipe and Smoke It

Be a pipe mechanic and repair your own smoking apparatus

By Albert E. Jones

A SHORT time ago the stem of one of my favorite pipes became clogged and no effort of mine could dislodge the obstruction, even though I used wire. After a little thought I took a steel knitting needle and flattened one end a little and with a file sharpened it as one would a drill. I also filed it somewhat flat for about an inch back from the point to allow the drilling room to back up. Using the needle as a drill I soon had a good passage through the stem and now the old pipe draws better than ever.

Pipes, like machinery, sometimes get out of order, but if you know how to repair them it saves buying a new one

If you want to change the shape of a hard rubber pipe stem, it is a very simple thing to do. A wire is run through the stem to prevent the hole from flattening and the stem is heated—preferably in boiling water.

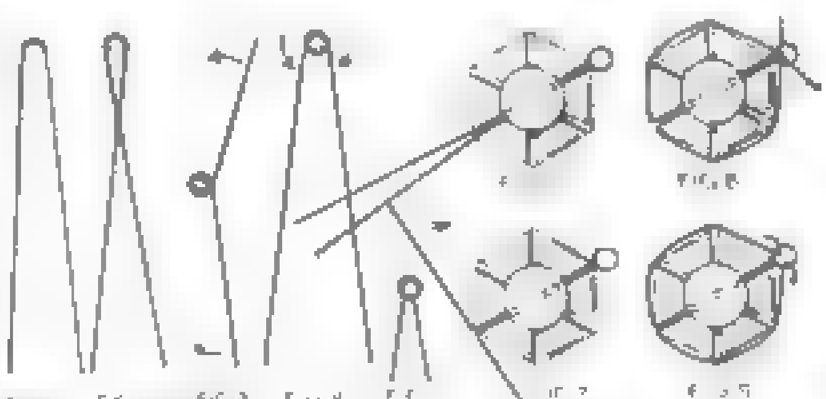
It will soon soften enough to be bent easily to any desired curve. Care must be exercised not to bend it while the rubber is still hard. After it is bent move the wire back and forth to free it and then allow the stem to cool, after which the wire can be taken out altogether.

The Hairpin Competes with the Cotter Key

THE method of using a hairpin in an emergency, described in the following paragraphs, is very useful to the motorist.

By twisting the hairpin as shown in the various figures in the illustration you can make a practical cotter key for screw-heads or bolt-ends.

These are forever getting lost or broken, especially those in the car springs, and it is very useful to know how to replace them immediately. The repair which forms the subject of our illustration can be done with a single hairpin in less than two minutes with no other tool than a pair of pliers.



The above diagrams show how a hairpin may be twisted around a nail to form a cotter key for a bolt head. This idea is excellent in an emergency

The double twisting of both ends of the pin in the ring make the improvised pin absolutely secure.—M. R. JOURDAINE

Electric Fan Dries Photographic Plates

BY an extremely simple device a small electric fan can be converted for drying photographic plates rapidly, and with a little care no dust will settle on them.

Construct a wooden box of such a size as to accommodate the size of the plates to be used. When the box is completed, screw on the inside, about half way up, cross pieces for supporting a shelf.

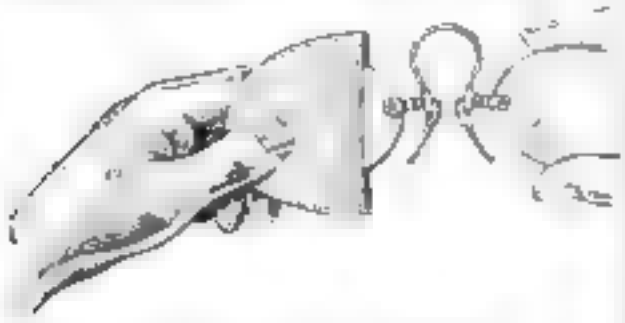
The shelf should be made to fit easily inside the box and it must be bored with 1/4 in. holes in rows throughout its length spaced so they fall between and not under the edges of the plates.

Racks having saw cuts in them to hold the plates are glued lengthwise along the top inner edges of the box. A hole about 2 in. in diameter is bored in one end of the box, under the shelf, to take the end of a cardboard funnel. This funnel might also be a megaphone, provided there is one handy. It should be large enough at the big end to fit over the guard of the electric fan.

To operate, place the wet plates carefully in the rack, put the small end of the funnel in the hole in the box and run the fan at "slow." The plates will dry in about five minutes.—V. VAN WINKLE.

To Clean Spectacles Quickly and Efficiently

A LITTLE chamois lined pouch like those usually supplied with watches, makes a much better spectacle cleaner than a handkerchief. A handkerchief has a certain roughness



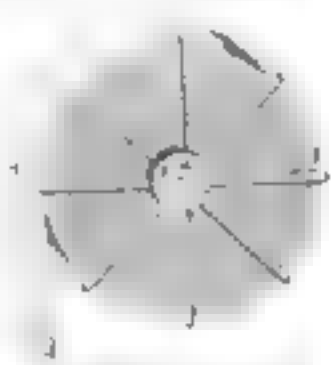
The chamois pouch for cleaning eyeglasses is far superior to the handkerchief, for it really does an efficient job

and always leaves lint upon the lens, whereas the chamois is soft and really cleans when used in the manner shown. These pouches are easy to make and once you adopt this scheme you will never be without one.—J. W. MOORE.

Eliminating the Unraveling of Friction Tape

ELECTRICIANS and other mechanics who have use for friction tape in their work generally experience trouble due to the unraveling of the outer edges of the tape when it is being unrolled for use.

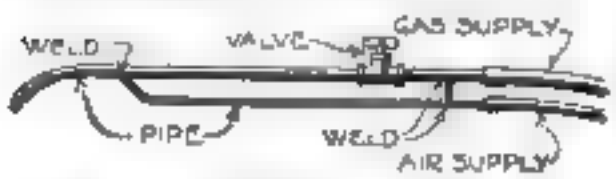
This annoyance can be easily overcome by scoring each side of the roll in radial lines with a sharp blade, as shown in the accompanying sketch. This simple operation does away with the unraveling, since it cuts the outer threads of the tape which are the cause of all the trouble.—PETER J. M. CLUTE.



Slit slightly the edges of the tape and it won't unravel or get ragged

To Make a Handy Gas Soldering Torch

SMALL soldering jobs which must be done in cramped quarters can be quickly and easily accomplished with this home-made gas blow torch. The torch is made from discarded



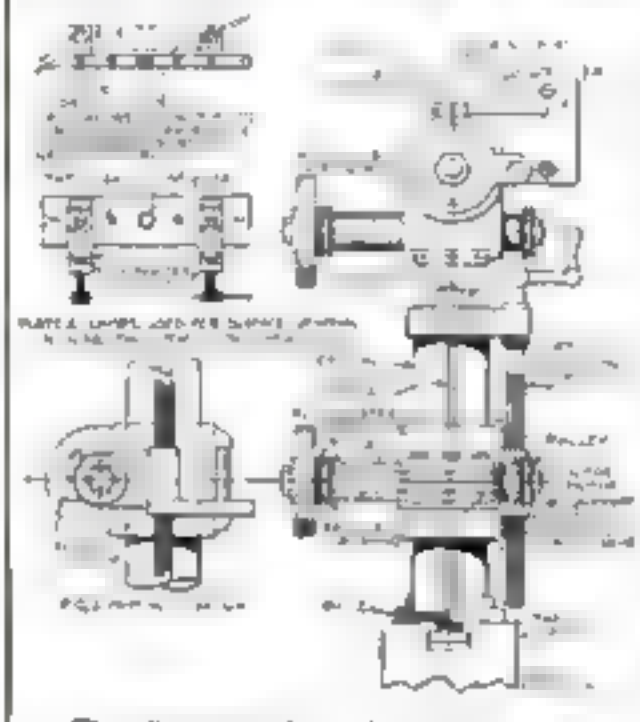
This gas torch is simplicity itself and serves exactly the same purpose as the expensive manufactured article

pipes and fittings, the illustration showing plainly how it is assembled. The torch is attached to the gas main by a length of rubber hose, while another piece connects with the air line.—RONALD L. PRINDLE.

Surface Grinder Lathe Attachment That Does Good Work

By H. H. Parker

THIS small lathe attachment will be found extremely useful for grinding various flat and cylindrical or disk-shaped articles, also, the grinding wheel and sleeve may be removed and a sleeve containing a drill chuck and pulley used in its place, or a plate holding one or two small vises may be clamped in place of the sleeve, in which case the device becomes a mill-



The diagrams show the various uses to which the apparatus may be put

ing attachment, the mills being held in the live center of the lathe.

A few diagrams are shown suggesting various uses to which the apparatus may be put. In the original, a ⅓6 horse power electric motor running at 1750 R. P. M. was used to drive the grinding wheel, the motor being bolted to a hardwood base fastened to the adjustable slide of the apparatus itself, making the whole self contained. A large hardwood drum pulley was attached to the motor shaft and belted to a smaller pulley on the grinder shaft, to give the wheel the necessary high speed for grinding. If a suitable motor was not at hand the device could be driven by a small round belt from an overhead countershaft, provided with a weight or some means for keeping the belt at constant tension.

The whole attachment can be, and the original was, built on a small lathe, which need not necessarily be of the screw cutting variety. Only one operation is not exactly in the line of lathe work, the cutting of the long keyway in the upright column, but this may be accomplished by turning the cutting tool over on its side and moving the slide rest along by hand, the action being similar to that of a shaper.

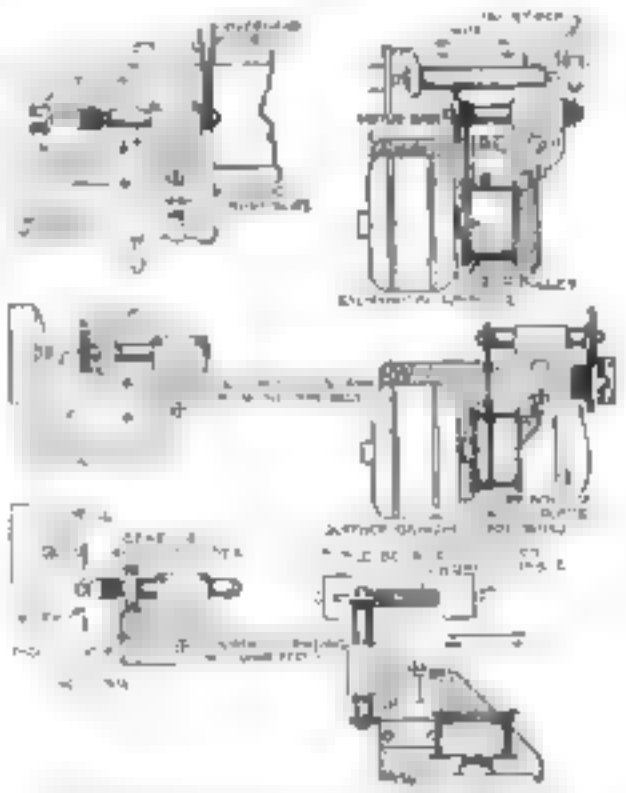
The machine consists of a steel or cast iron column drilled for a holding down bolt which clamps it to the tool slide of the lathe; a cast iron base is screwed to the bottom to increase the bearing surface. A split cast iron slide works up and down on this column, being adjusted by the screw and handle shown and clamped in place by a clamping bolt through the split portion.

This slide (E, F, G, H), has a projection on one side bored out to take a horizontal steel sleeve and is split horizontally and provided with tightening screws to clamp the sleeve in any position. The opening for the sleeve may be drilled and then bored out to size by means of a boring bar between lathe centers, the slide being clamped to the column and the latter bolted to the tool slide during the operation.

A bronze bearing in each end of the sleeve holds the grinding wheel shaft in position. It is best to drill and ream the sleeve, then machine the outside concentric with the bore and then insert the bushings and run a reamer through them, thus bringing them in line for the insertion of the shaft.

No dimensions are given, for the size of the apparatus would depend upon the lathe upon which it was to be used; but the proportions should be about as shown in the drawing.

Some sort of a table will be needed to hold the work for surface grinding and about the easiest way to make one would be to take a piece of cold rolled

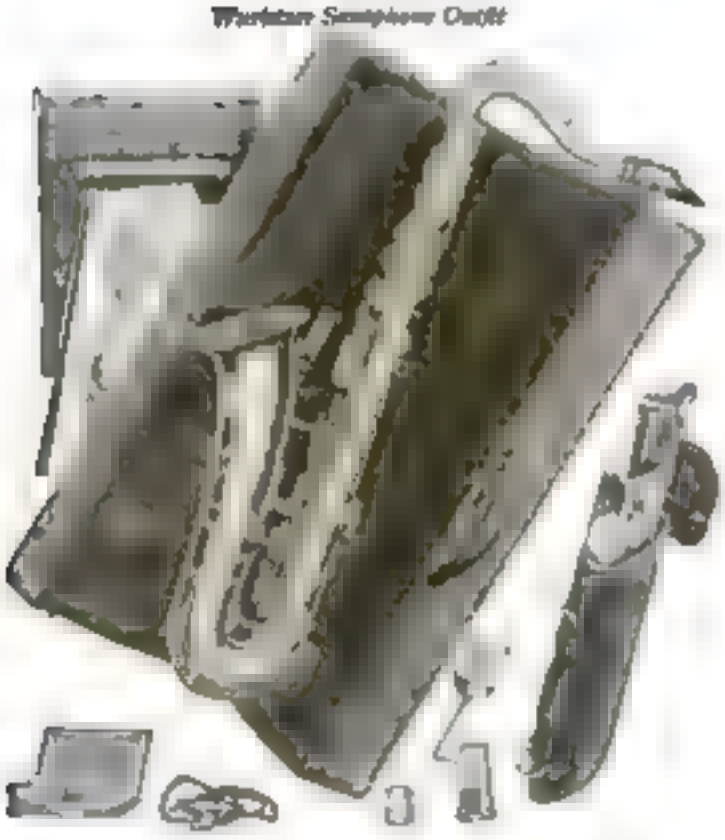


The whole attachment can be built upon a small lathe, which need not necessarily be of the screw cutting variety

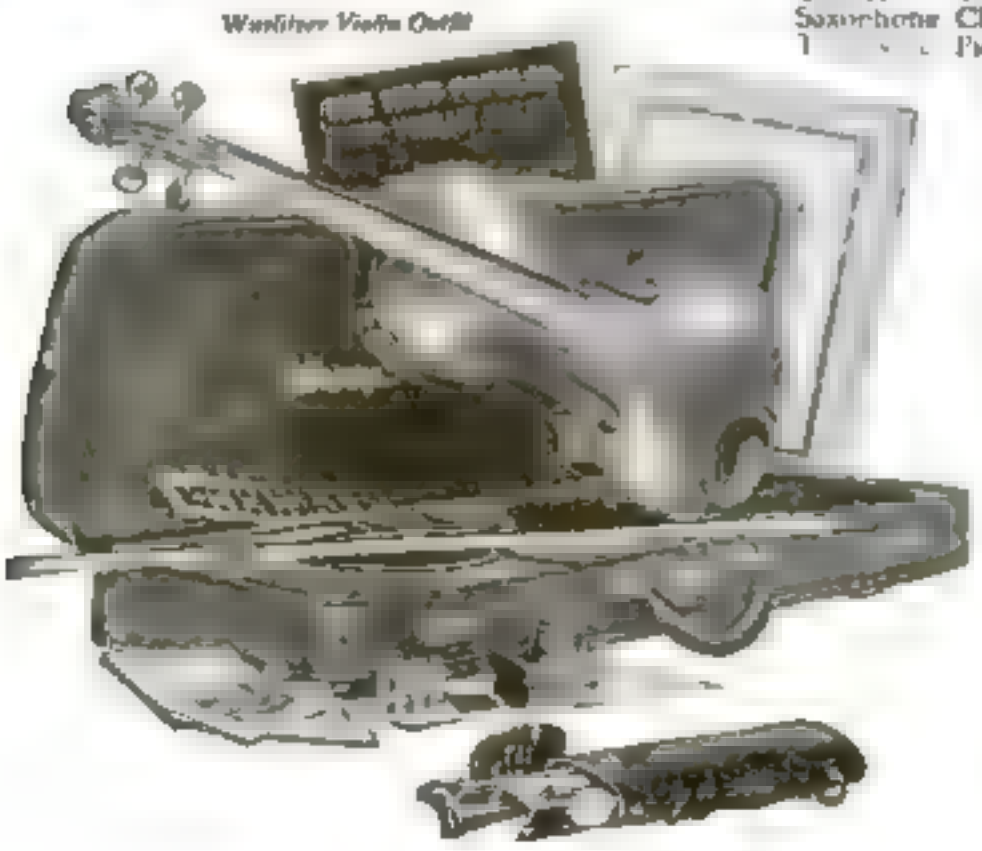
steel about three eighths thick, an inch and three eighths wide and as long as desired. Drill and tap a hole in the center to ½ in. by 20 in. and a series of smaller holes along the center line for 10 by 24 machine screws. Each end of the plate should be center drilled so that it may be held between

Wurlitzer Cornet Outfit

Wurlitzer Saxophone Outfit



Wurlitzer Violin Outfit



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T	Piccolo	Guitar	Mandolin	Ukelele	Cello

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lathe centers; this method will be found to hold the table firmly enough for any of the grinding operations which might be performed upon it. The work could be screwed or clamped to the table, but the best way would be to procure a couple of small vises or clamps and screw these to the table and clamp the work in them.

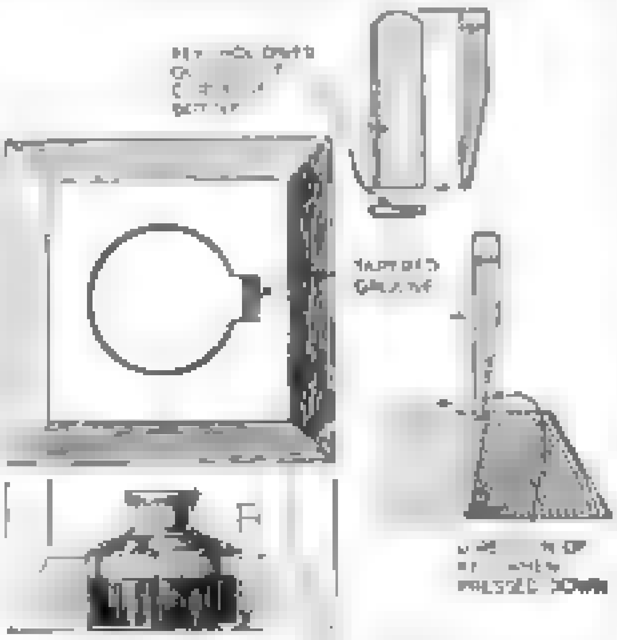
To use the attachment as a milling device, with the milling cutters held in the lathe chuck, screw a short mandrel of the same diameter as the grinding wheel sleeve into the above described surface grinding table and clamp the mandrel into the slide after removing the grinding wheel and sleeve. Now we have an adjustable milling vise to hold the work while it is operated on by the cutter in the live center.

In using this lathe attachment it will be noticed that two of the necessary adjustments, namely, longitudinal and transverse, are provided by the apron and tool slide of the lathe itself, while the remaining or up-and-down adjustment is actuated by the handle and screw working through the slide on the column.—H. H. PARKER.

An Ink-Bottle Holder that Won't Upset

EVERY draftsman knows how often the ink is upset while he is working. A stand to keep the ink-bottle steady may be made from two small pieces of hard wood.

The base is a block of hard wood 4 in. by 4 in. thick. The hole to receive the bottle in the base is bored a little bit larger than the diameter of



The ink-bottle that will not upset proves a boon to the draftsman or artist. It is easily made

the bottle; this is done with an expansive auger wood-bit.

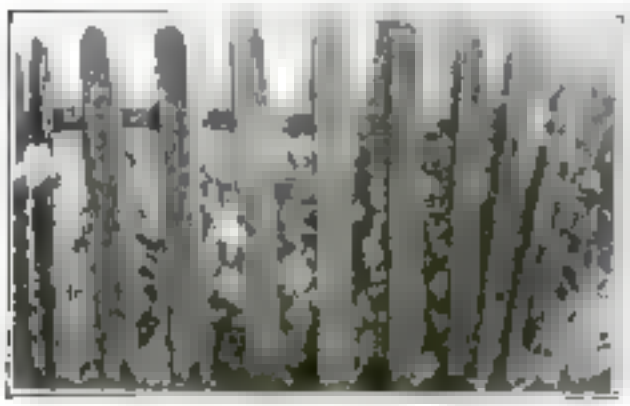
The wood key or wedge must be tapered and the flat side facing the bottle must be hollowed out to fit the curve of the bottle.

The groove in the block is cut so that it will taper to correspond with the angle of the keys, thus, when the key is pressed down, it will wedge the bottle and keep it from dropping through the base.

The stand may be finished with a stain and polish.—M. TOCABEN.

Wagon Felloe Makes Round Fence Corners

EVERY farm has several old wagon wheels lying about. They can be used to make round corners for picket



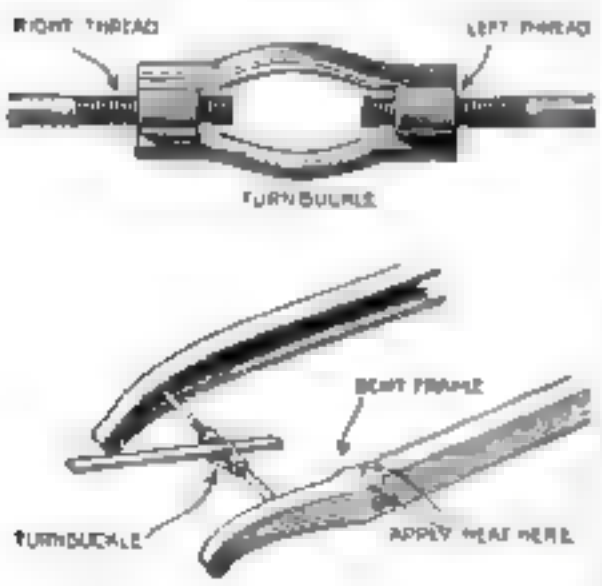
Improve those staggering fence corners by attaching a wheel felloe which rounds gracefully

fences and this will greatly improve the appearance of the fence.

The wheel is first sawed at one point, then the spokes and hub removed. The felloe is next measured on the contemplated corner and the surplus material removed. Then the pickets are nailed on in the usual manner, completing a neat and easy repair.—CORA HAMILTON.

How To Straighten a Bent Automobile Frame

IT is not a difficult task to straighten a bent chassis framing, and very few tools are required. The necessary force can be provided with an ordinary turnbuckle, as indicated in the illustration. Various forms of jacks can also be used for the purpose, but the turnbuckle is the favorite of at least one repairman, who has applied it on



A bent framing can be readily straightened by means of a gasoline torch and turnbuckle

so many occasions that he has become an expert

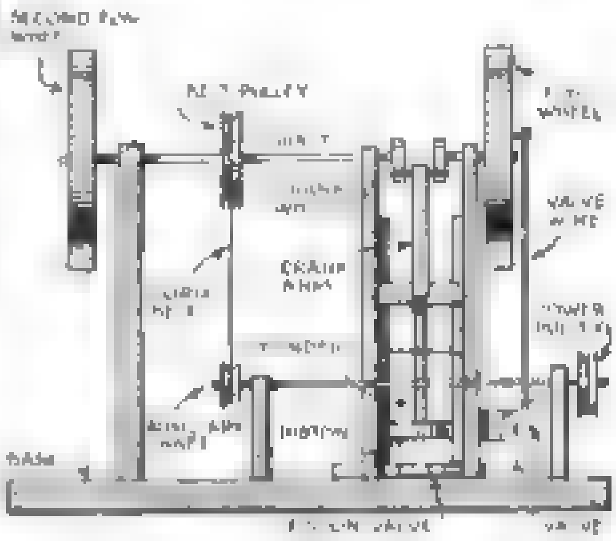
The heat from an ordinary gasoline torch is sufficient to soften the metal to the point of bending under the stress of the turnbuckle. Even a comparatively small torch can be used, as the idea is not to melt the steel but merely to reduce the bending point, and this is accomplished long before the melting temperature is reached.

This Toy Steam Engine Gives Valuable Instruction

A MINIATURE steam engine that will give the builder a great deal of satisfaction can be made by using a bicycle pump as a cylinder and constructing the parts mostly of wood

On a base of wood three upright posts are secured by means of screws. Each of these posts is 18 in. long and 2 in. wide by 1 in. thick. The two posts near each other and on one side of the base are 2 in. apart, while the third is located in line with the others but 12 in. away.

Between the two posts the cylinder is located. This may be made from an old bicycle pump housed in a wooden block 2 in. square at the ends and 6 in. long. The original piston of the pump is left in place. Across the



Made from pieces of wood, wire and an old bicycle pump this toy miniature steam engine offers first rate instruction for the youngster

lower end of the cylinder a brass pipe is soldered to hold the valve that admits and cuts off the steam, this being a single action engine. This pipe should be ¼ in. in diameter and 4 in. long. Near its middle a hole is punched and this hole placed over the lower end of the cylinder, in which position the two are soldered together.

The crank arm is secured to the upper end of the piston rod by a piece that works up and down between the posts in grooves purposely cut for it. The crank wheels hold the upper end of the crank arm between them, a wire 3 in. from the circumference of each passing through the end of the arm

The two flywheels are cut from inch lumber with a compass saw and should measure 12 in. in diameter. The crank wheels are 4 in. and cut from inch lumber of some hardwood variety. Holes near the top of the three posts act as bearings for the shaft and a cord belt is used to connect the shaft with the auxiliary shaft. Upon this second shaft the belt pulley is located.

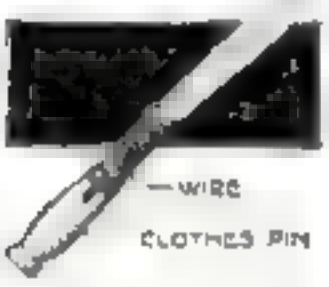
The valve that allows the steam to enter the cylinder is made from a V-shaped piece of hardwood pivoted to the post as shown in the diagram. A wire from the flywheel operates this arm when the wheel rotates so that the valve is opened and closed. A

small piston valve located in the pipe that was soldered to the base of the cylinder is also connected by a wire to the valve piece. As the wheel rotates it will cause the valve piston to move back and forth across the entrance into the steam cylinder. By timing the valve a position may easily be found where the steam will be allowed to enter the cylinder just as the piston starts upward and will also be cut off just as the piston starts downward.

Compressed air can be used as well as steam for the operation of the engine. Its originator soldered the head in a milk can and built this into the arch to form his boiler.

To Reclaim Kitchen Knives that are Handleless

IN almost every household there are knives that have lost their handles and yet are beloved of the housekeeper because of some peculiarity in the shape of the blade or other feature. Also in every household there are clothespins An ingenious housewife has found that by cutting off the prongs of a clothespin about an eighth of an inch shorter than the tang of the knife-blade, winding over the slotted part with cord or, better yet, wire, and filling the space around the tang with melted sealing-wax or melted rosin, the good old blade can be given a new lease of life.

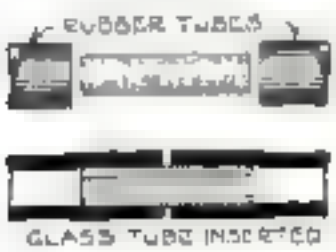


Overcome the H. C. of L. in the kitchen by supplying old knives with new handles

The object of cutting off the legs of the pin is to allow the point of the tang to be slightly driven into the wood in the crotch. A handle made in this way is surprisingly comfortable and convenient to work with.—HOWARD GREENE.

To Get the Most Out of Rubber Tubing

WHEN a rubber tube gets a hole or two in it, don't throw it away. Buy a piece of glass tube at the drug store. Cut the rubber at the spot where it leaks and insert a small piece of the glass tube, and, presto! your tubing is as good as new.



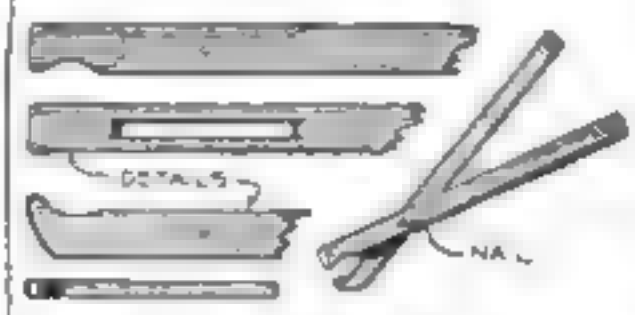
Don't throw that leaky rubber tubing away. Make it as good as new with glass tubing

The glass tube may be easily broken into sections by cutting notches in it with an old knife and then snapping the tube between the fingers.—A. B. WEGENER.

Tool for Handling Fuses for Heavy Voltage Currents

LINEMEN and electricians who have occasion to remove or install fuses in high tension lines will appreciate the little tool described below. This tool is simple and may be the means of preventing a severe burn or shock as a result of coming in contact with live wiring.

Cut off a section of broomstick about a foot long and saw a slot near



There is no possibility of a shock when handling high voltage wires if these tongs are used

one end about six inches long. Drill a small hole through the stick at right angles to the slot and about halfway down its length. The slot should be at least one half inch wide.

Next cut out a piece of hard wood the shape indicated in the illustration and fit into the slot, driving a nail through it and the holes in the broomstick so the combination will work like a pair of scissors.

Soak in melted paraffin and it is ready for use.

The fuse can be grabbed up with the aid of this tool without the least danger.—THORNTON HALLET.

Remember This When Your Automobile Won't Go

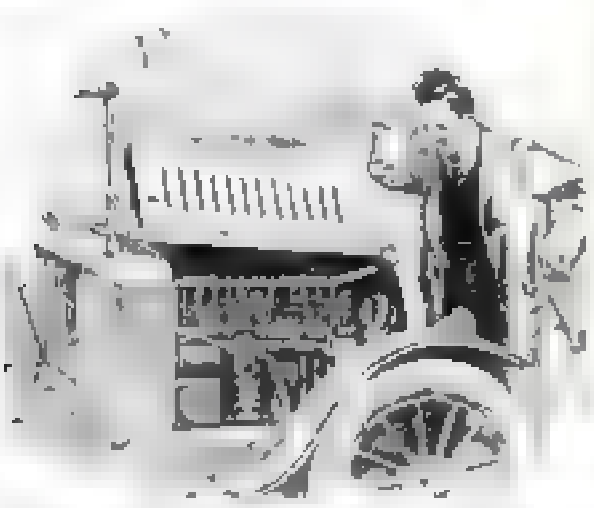
THE greatest difficulty the trouble locater has to face is taking things for granted.

All of you know that it is impossible to start a car with the switch in the "off" position, and yet it is a daily occurrence to see men try to crank a car without first throwing on the switch. Recently we saw a man crank his car for twenty minutes with the switch off. The ignition switch was set in the center of the lighting switch handle. Therefore the absolute position of the switch key varied according to what lights were on—hence his mistake; yet this man looked all over his engine before he discovered the trouble. Being absent-minded probably had something to do with it.

The other day we started to take a ride in the country and after we got a few miles out our engine stopped dead. I began to figure all sorts of things. We had filled the tank with gasoline and had taken plenty of oil, so we knew this could not be the trouble. If I had been driving that car alone, I venture to state I would have been there indefinitely as I could not see what was the matter with the

"durned" thing. But the fellow driving the car was an old time motorist, and immediately asked his wife for a hairpin. He crawled under the car and found that the gasoline feed pipe was choked with a piece of rubber from the gasoline hose. In a couple of minutes we were under way again.

An automobilist who had just had the valves ground, found that the compression in the first cylinder was weak. He removed the exhaust valve but found it in perfect condition. He then took out the intake valve but found that too in perfect condition. The difficulty did not seem to be due to too small a clearance between the valve stems and push rods, because the clearance was the prescribed amount on both the intake and exhaust valves. He concluded that it must be the piston rings which might be either gummed or broken. Flooding the cylinder with kerosene did not improve the condition, so a pint of very heavy oil was put in with the idea that this would temporarily stop any leaks between cylinder and piston, but still the compression was no better. Several times he was tempted to increase the clearance between valve stems and push rods, for no sensible



Numerous accidents happen through thinking the car is in order. Never take things for granted if you own an automobile

reason, because the clearance was correct, but simply in desperation. It seemed about the only thing left to do—it was the only thing he had not tried. But his common sense said no, so he took his car to the local garage. The first thing they did was to increase the clearance on the intake valve, and the trouble was cured. The reason for doing this was that there was a high spot on the back of the intake cam which would open the valve a slight amount on the compression stroke. The clearance was increased to a point where the high spot had no effect.

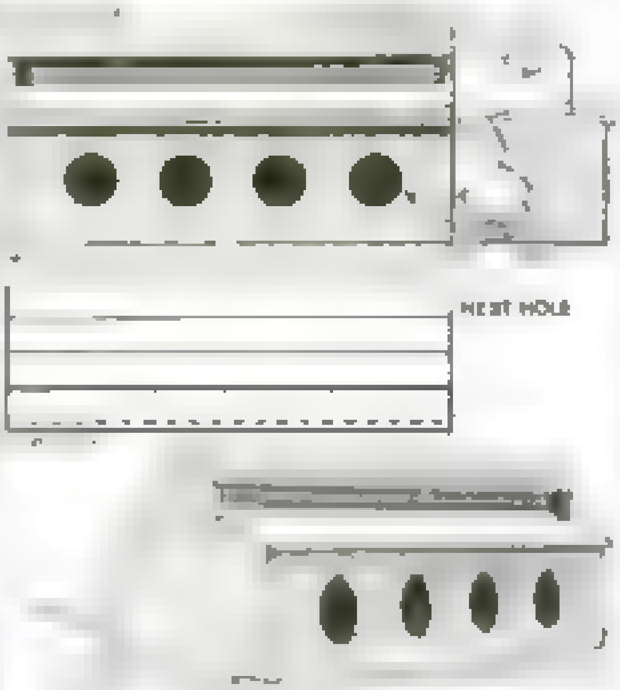
These various incidents prove that it is unwise to take things for granted. It is also important to bear in mind that it is not wise to use too much logic in trouble hunting, for the solution is often far from logical. It is a good thing to reason as carefully as possible but if the solution is still to be found it often happens that it is obtained by some illogical act.

Combination Feed Hopper and Nests

THE accompanying sketch illustrates a combination feed hopper and nest boxes which have proved an ideal combination.

The feed trough was built of wood with a metal partition, as indicated, suspended from between the cover boards to within about 3 in. of the bottom of the trough. This trough was about 2 in. deep and 10 in. wide and 5 ft. long.

Then a nest house was constructed, as shown, 5 ft. long, 2 ft. wide and 2 ft. high. A notch to accommodate the trough was cut in each end board and the trough set in. Then the top boards of the nests were put in place on a slight pitch as shown. Nests were partitioned off separately and the entrances were in circular form, the bottom edges being about 10 in. from the floor so straw could not be scratched out.



Combining the feed hopper and poultry nests enables the hens to feed out of the trough without crowding each other

The hens are compelled to stand on the roof boards of the nests to feed out of the trough but cannot crowd owing to the slant of the roof. They also cannot get into the trough because of the tin partition, but still can eat without spilling or throwing out the contents.—THORNTON HALLETT

Adjusting the Electric Light at Will

KEEPING the light at exactly the right height, whatever the nature of the work, is an easy matter for a certain clever mechanic. Overhead he has fastened a curtain roller to which is attached a string with a loop at the free end. Through this loop the cord with the electric light is passed. Whenever the light is needed closer to the work, he simply unrolls the string until the illumination is satisfactory. Raising the light is as easy as raising a window curtain.—FRED TELFORD.

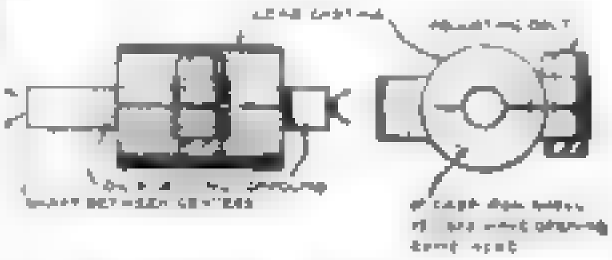
Lead Lap for Finishing Shafts to Size

To make the lap a lead casting is required about the proportions shown in the drawing, cast in a wooden or plaster-of-paris mold. This may either be drilled out afterwards or a steel rod about five thousandths of an inch smaller than the required shaft diameter may be placed in the mold and the lead run around it, after which it may be driven out and the hole reamed.

A piece of thick pasteboard may be set in the mold where the lap is split; this will save sawing afterwards.

A hand reamer is then run through the hole taking great care that it does not cut the hole "bell mouthed." This may be prevented by having the hole nearly to size before reaming so that there will not be much material to remove and then being careful not to apply side pressure to the reamer.

A bolt is put through one of the lugs to close the lap slightly, though this



This time-saving lap will polish the surface, smooth off eccentricities and bring the shaft to size from end to end

adjustment should not amount to more than two thousandths. The opposite lug is merely to balance the lap.

A better construction would be to make a split cast iron shell and run the lead into it; the center opening of such a shell would be about where the dotted lines are shown in the drawing. In this case a number of lead castings with different sized holes could be made to fit into the iron casting, provided the opening in it was smoothly bored out.

If the reader has not access to a foundry or cannot do the machine work required for the iron casting, a plain lead casting as described above will give satisfactory results.

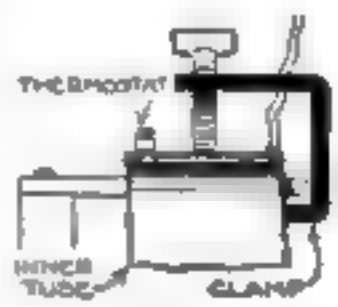
To use the lap, finish the shaft as nearly as possible to required dimensions, as mentioned above, then smear the lap and also the shaft with oil and emery or valve grinding compound. Rotate the shaft rapidly in the lathe moving the lap back and forth and also rotating it by hand (to prevent its being worn one sided), tightening the adjusting bolt from time to time, if necessary, but very slightly, and frequently stopping the lathe, wiping off the shaft and measuring it. A contrivance of this sort will soon pay its original cost in a hundred ways and it will be invaluable to the mechanic. It occupies but little space when it is not being used.—H. H. Parker.

How to Construct an Electric Vulcanizer

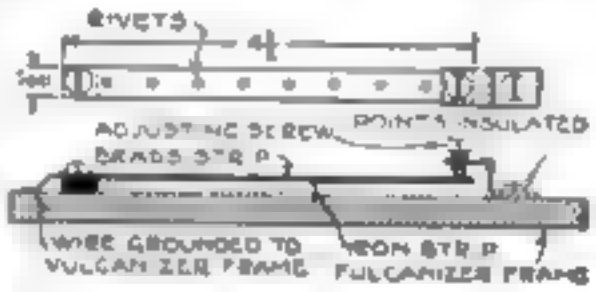
By C. L. Smith

THIS vulcanizer is designed for 110 volts A.C. or D.C., and has an automatic heat-controlling thermostat. It consists properly of three units: the heating unit, the control unit, and the clamping unit, all of which can be made for a very small cash outlay plus a little spare time.

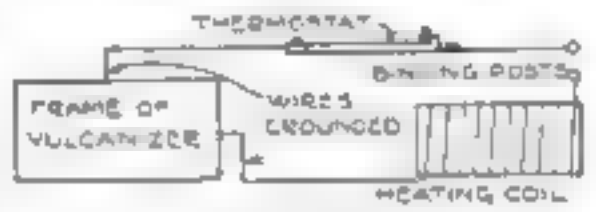
To build the heating unit, procure a strip of light sheet-iron or heavy tin, 9½ by 6 in., and bend it into an L shape, making the stem of the L 4½ in. high and the base 4 in. wide. Cut three strips of asbestos 6 by 8 in., ½ by 5½ in., and 3¾ by 5¾ in. respectively. The 3¾ by 5¾ strip is to be used for the heating coil. On this strip wind about 110 ft. of No. 22 iron wire (or resistance wire of 110 ohms resistance), being careful that the successive layers of wire do not touch each other and cause a short circuit. Then place the



This device set up and attached to the tube

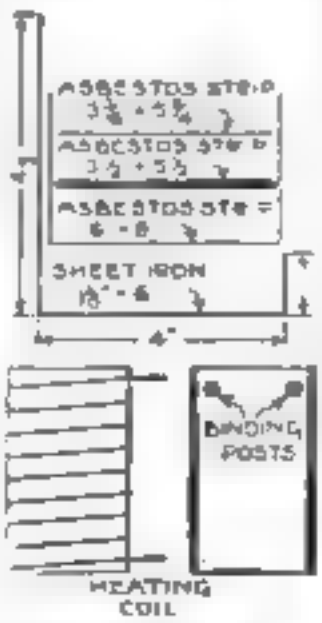


The thermostat will not function unless the brass strip is on the top side



A glance at the illustration will show the exceeding simplicity of the traction wiring

4½ by 6 in. piece of asbestos over it so as completely to insulate the heating unit from the metal of the vulcanizer. Now bend the L-shaped piece of metal down over the coil. Bring out one wire of the coil to one of the binding-posts and ground the other to the frame.



The heating coil and dimensions for cutting the asbestos strips

To construct the thermostat procure two strips of dissimilar metals (iron and brass) ⅛ by 4½ in., and rivet them together, placing the rivets ⅜ in. apart. Rivet one end of this strip on top of the vulcanizer and bend the strip up slightly so that it will clear the metal of the instrument except at the place riveted, but yet lie parallel to it. Take a strip ⅛ by 1½ in. long and bend it as shown in the sketch, and fasten it to the vulcanizer, using asbestos to insulate it. Lead a wire from this strip to the other binding post. Be sure that these binding-posts are insulated. Now provide an adjusting screw.

The thermostat will not operate unless the brass strip is on the top side, or on the side next to the adjusting screw. The screw regulates the heat of the vulcanizer. The proper temperature is 260° F

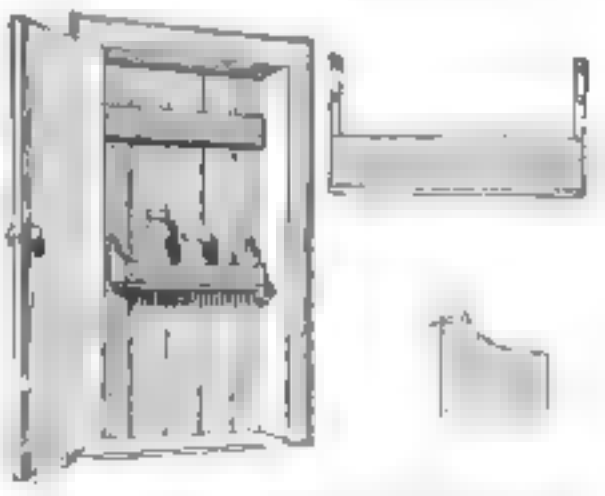
The vulcanizer is now complete. An ordinary hand clamp can be used to clamp it upon the inner tube. It will take about fifteen minutes to vulcanize a small patch and up to thirty minutes for a large patch.

By studying the diagrams no trouble should be experienced in making the apparatus. If it is made round instead of flat it can be adapted to easing repair work.

Space Between Doors Acts as a Refrigerator

AS a rule, in places where there are no ice-chests or cooling devices, milk bottles and the like are placed on the floor near the door to keep them cool. They are thus often in the way and consequently are apt to become broken or spilled

One suburbanite solved the problem by attaching a little shelf, as illustrated, to the inside of the storm door. Thus the food or liquid was always enclosed in a cold air space between the two doors, was out of the way, and was instantly accessible for use.



Why not attach a shelf to the storm door and eliminate the ice-box for the winter?

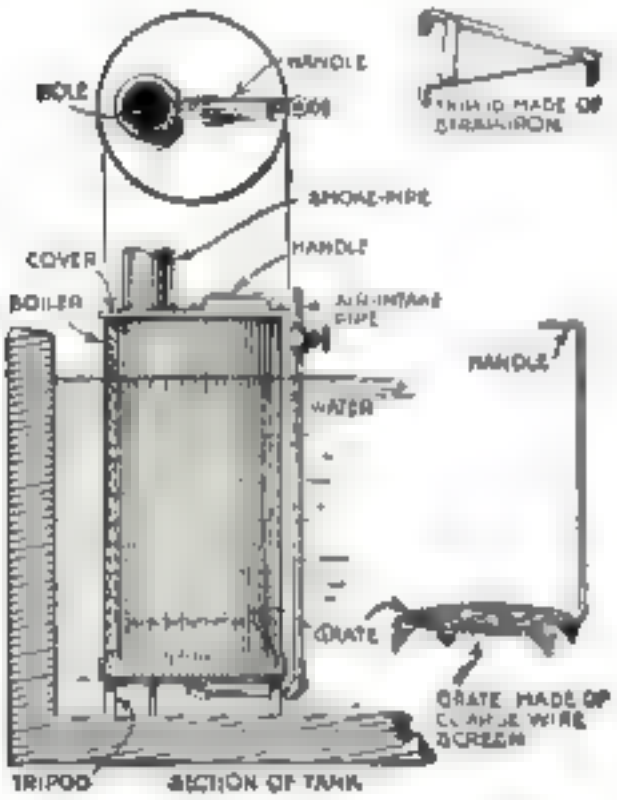
Spring clips inside the edge of the shelf kept the bottles from tumbling off when the door was opened quickly.—L. B. Robbins.

An Inexpensive Heater for Farm Watering Tanks

As an inexpensive though efficient substitute for the portable heaters now on the market to keep the water from freezing in watering tanks for farm stock, the following idea will prove of value.

Procure an old but tight hot water boiler and cut it down to a height which will allow it to project at least a foot above the maximum water level in the tank. Plug up all side openings with regulation pipe plugs, threading in tight to prevent leakage.

Cut out a cover of sheet iron for the top and provide it with several lugs around the circumference to hold it snugly to the sides. One side of the cover is supplied with a hole for a small stove pipe. This should have a collar to prevent its slipping down in the boiler. Attach a handle of strap iron to the opposite side of the cover.



Here is a heater that is simply placed in the water at one end of the tank, then a fire is built in it

The air intake is composed of piping, as shown, which is threaded into the hole in the bottom of the tank. If desired, a valve can be inserted in this pipe to regulate the supply of air.

As the intake pipe projects below the bottom of the tank, construct a tripod of strap iron like that shown in the sketch so the piping will just clear the tank bottom.

A grate is made by cutting out a square of heavy screen wire and bending down the corners so it will stand in the inside of the boiler about 6 in. above the bottom. A stiff wire handle should be attached to lift the grate out when cleaning.

This heater is simply placed in the water at one end of the tank and a fire built on the grate of slow burning material which can be replenished at will by raising the cover. Draft, of course, is regulated by the valve in the intake pipe and a damper in the smoke pipe.—WINDSOR CROWELL.

For the Radio Experimenter

Practical Operation of Thermionic Detectors

By H. J. van der Bijl, M. A., Ph. D.

NO piece of apparatus holds the attention of radio men as steadily as the thermionic detector. No matter what the name applied—whether "thermionic detector," "triode tube," "electron tube" or just plain "vacuum valve"—the appliance, out of all the radio experimenter's apparatus, is nearest and dearest to his heart. It can accomplish most of all.

Herewith we present an article on the practical manipulation of tubes by one of the country's leading authorities, Dr H. J. van der Bijl of New York City. It follows one in our October number. Besides these two articles on tubes as receivers, Dr. van der Bijl will shortly write three on tubes as amplifiers, oscillators, and modulators. The series is attracting wide attention. Few discussions have proved so understandable, and yet so close to the core of the subject. The diagrams are very complete.—EDITOR.

THE vacuum valve or thermionic detector has made it possible to detect, with a simple outfit, electromagnetic waves coming from considerable distances. It consists simply of an evacuated glass bulb containing a filament which can be heated to incandescence, a pair of metallic plates and a pair of metallic grids placed between the filament and the plates. Instead of plates a cylinder is sometimes used, in which case the "grid" takes the form of a helix enclosing the filament.

When the filament is heated to a high temperature it emits electrons. If a positive potential is applied to the plate the electrons are drawn to the plate and so there is established a current through the tube. The magnitude of this current depends on the potential of the plate with respect to that of the filament. It can also be varied by varying the potential of the grid. Suppose the tube be connected in a circuit like that shown in Fig. 1 in which the plate is maintained at a constant positive potential with respect to the filament by the battery E_p. Let us say that the negative end of the filament is grounded. Then if the potential of the grid be varied by sliding the contact a along the resistance r the variation in the plate current obtained can be represented by the curve abc of Fig. 2. When the grid potential is zero the current as measured by the meter A will be that given by the magnitude oa. If the potential of the grid now be made negative with respect to the filament the grid would tend to repel the electrons coming from the filament and drive them back to it. The plate, on the other hand, tends to pull them away from the filament, but on account of the opposite effect of the grid the current will now be less than when the grid was not at a negative potential. And so the plate current decreases as the negative grid potential is increased and finally becomes zero when the grid potential reaches the value given by oc. For lower plate potentials the curves de and fg will be obtained.

The fact that the characteristic is not straight but curved makes it possible to use the device to detect electromagnetic waves. For, suppose that the plate potential is such that for zero grid potential the current is that corresponding to the lowest curve, namely that given by the magnitude oe. If now an alternating potential be impressed on the grid, as indicated by the wave curve below o, the current will be alternately increased and decreased as shown by the wave to the right of the curve. The input voltage, shown below o, is symmetrical, that is the positive and negative peaks are equal, and if it is a high frequency wave it will not be audible when passing through a tele-

What Radio Experimenter Couldn't Find a Use for These?

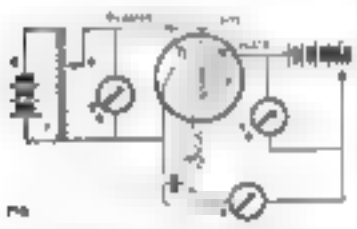
Interesting tubes in the collection of Dr. Lee De Forest, inventor of the audion, or [illegible] three-electrode tube. The large one at left is a [illegible] oscillator. Filament [illegible] plate 1500. Top row: (1) Spanish Type B. Filament 6 volts, plate 30-50. (2) Pre-war ultra-audion. F. 3.5 v. Pl. 30. (3) Spanish receiving tube "Compagnie Espagnole." F. 3.5 v. Pl. 30. (4) Moorhead receiver. F. 4 v. Pl. 40-500. In center (left): Early De Forest tube 1906. F. 3.5 v., Pl. 25. (right): Historic tube. Went around world on battleship Georgia with the fleet, 1908. F. [illegible] Navy used tubes regularly. Bottom row: (1) West. Elec. VT [illegible] F. 6 v. Pl. 40. (2) [illegible] (De Forest) F. [illegible] Pl. 150. (3) Small power tube. F. [illegible] Pl. up to 500. Detector, amplifier, oscillator. (4) VT-21 Signal Corps detector. F. 4 v. Pl. 20-40. (5) Navy detector, oxide filament. F. 6 v. Pl. 40.

At top of page: Airplane radio apparatus assembled for laboratory test. It uses many tubes

phone receiver. The current wave in the plate circuit, on the other hand, has larger positive loops than negative. Such a wave consists of a number of component parts, one of which is a direct current, so that this wave will be indicated by a direct current measuring instrument. What this amounts to in the vacuum tube is that the normal plate current or will be increased as long as the incoming waves are impressed on the grid circuit of the

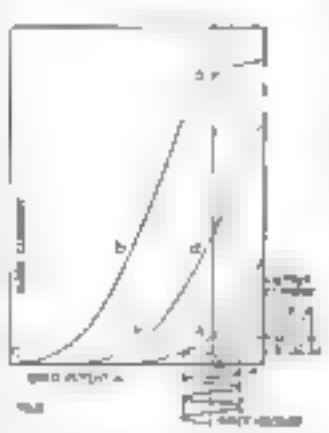
Airplane transmitting and receiving set, one detector, two amplifiers, a modulator Transmitting tubes are inside the coil merely to save space—important on airplanes

tube. Now, if these waves are interrupted, say, a thousand times every second and a telephone receiver be included in the plate circuit, then the successive rushes of current through the receiver every thousandth of a second causes a note to be heard in the receiver. The inaudible high frequency waves are thus made audible.



Circuit for obtaining characteristic curves of a vacuum tube

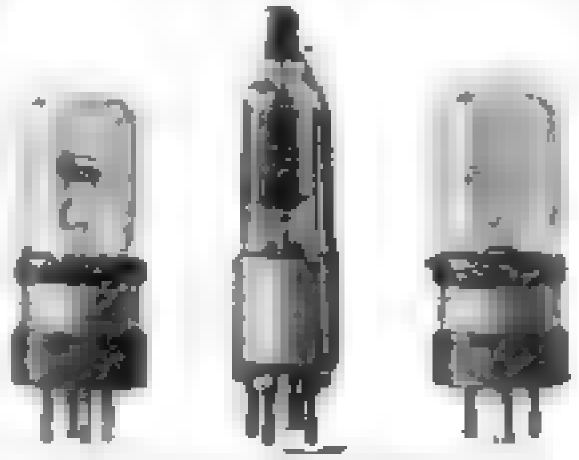
A simple circuit whereby this can be done is shown in Fig. 3. The circuit LC is tuned by varying the condenser C until it is in resonance with the antenna circuit A. This can readily be done by adjusting C until the tone in the receiver is of maximum loudness. The condenser C_2 has a small capacity of about 500 micromicrofarads. It acts as a by-pass to the high frequency components of the current in the plate circuit but offers a high impedance to the audio frequency current which must go through the telephone receiver.



Curves resulting from the experimental circuit shown in Fig. 1

In order to obtain the best results it is necessary to adjust the plate voltage to its proper value. There is a part of the curve (Fig. 2) at which the rate of curvature is greatest. This is the part at which

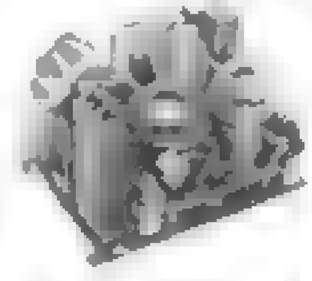
we must operate to get the loudest signals. In the case of the lowest curve shown in Fig. 3 the plate voltage is so adjusted that this part is at *e*, that is, it is on the axis of zero grid voltage.



Three German tubes picked up by American radio men in the war zones

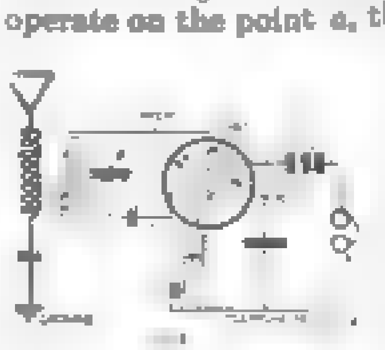
Suppose now that the plate voltage is increased so that for zero grid voltage the plate current is given by *od*. Here the curvature of the characteristic is so small that the effect on the receiver by the incoming oscillations will be practically nil. But we can increase the effect by increasing the negative grid voltage until the current is reduced to the value given by e_1. Here the effect on the receiver will be about the same as at *e*. But this makes it necessary to use a grid battery which can be inserted between the filament and the condenser C (Fig. 3). It is seldom necessary to use a grid battery when operating the tube as a straight detector, such as shown in Fig. 3. But this consideration shows that if it is necessary to use a grid battery, the plate voltage must be correspondingly increased.

Short-wave receiving set to be used on airplanes. Its wave length is 55-110 meters



Airplane sending set. This, and the one above, render trailing aerials unnecessary

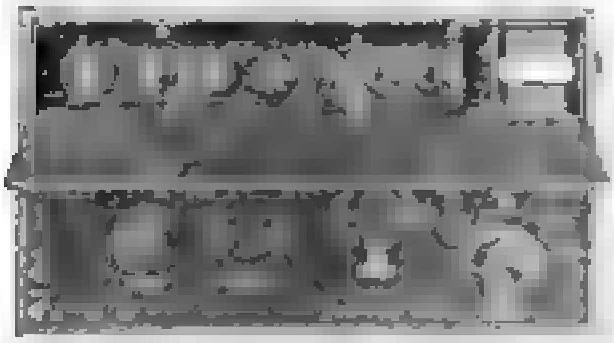
If the plate voltage is such that the curve *abc* is obtained and if we operate the tube without a grid battery, that is, we operate on the point *a*, then the effect is opposite to that obtained when operating at *e*, because here the characteristic curves the other way. The effect is that the plate current passing through the telephone receiver will be decreased whenever the incoming oscillations are impressed on the grid. This will also produce an



Typical receiving circuit for vacuum tubes—without the blocking condenser

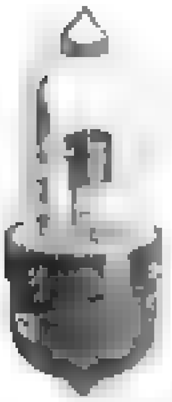
audible note in the receiver. It is therefore possible to operate either at the lower or the upper bend of the characteristic. It is, however, usually more desirable to operate at the lower bend, because this requires a lower plate battery.

The filament current must, of course, be adjusted to its specified value. If the tube contains an appreciable amount of gas it will be found necessary to adjust the filament current



Compact set designed for use on the army tanks in warfare. Seven tubes are installed

constantly to obtain the best results, because such tubes are very inconstant. If the tube is well evacuated, however, the filament current can be adjusted once for all. Some tubes are designed to operate over a wide range of filament current and plate voltage. For example, the VT-1 type of tube designed and manufactured by the Western Electric Company for the U. S. Signal Corps, operates with a filament current ranging from 1 ampere to 1.25 and a plate voltage of about 17 to 22 bolts. With tubes of this kind, therefore, the operator can give all his attention to the tuning circuit. This makes radio receiving extremely simple.

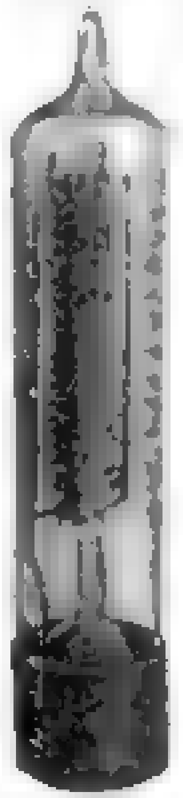


A tube of low capacity for taking short wave-lengths; it is English

There is this to be said about the appearance of the filament. Some tubes, like those made by the General Electric Company, contain tungsten filaments, and these operate at high incandescence—about as bright as an incandescent lamp. On the other hand, tubes made by the Western Electric Company contain the coated type of filament. These must never be operated at high incandescence. In fact, the temperature must never be raised to more than a yellowish red, because this only shortens the life of the tube and contributes nothing to increasing its sensitiveness. The coated type of filament emits electrons more easily than tungsten and will therefore give the same thermionic current at a lower temperature.

The audible component of the current in the telephone receiver when high frequency oscillations are impressed on the grid circuit, is called the detecting current. This current is usually very small. Some telephone receivers are capable of giving an audible tone when the alternating

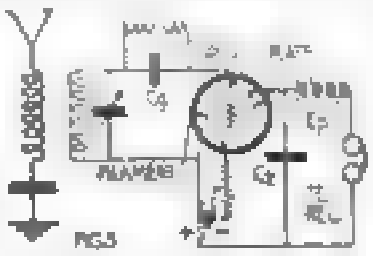
current passing through it is only a few billionths of an ampere. The detecting current can therefore be of this order of magnitude and still give audible signals. A way of measuring the detecting current has been devised by the writer. Suppose we measure it for different values of the plate battery voltage, the grid battery, let us say, being omitted. Then as the plate voltage increases the detecting current increases, reaches a maximum value and then decreases again. This is shown by the curve in Fig. 4. The point *e* corresponds to the point *e* of Fig. 2.



One of the power tubes that transmitted speech by radio, Washington (Arlington) to Honolulu and Paris, back in 1915

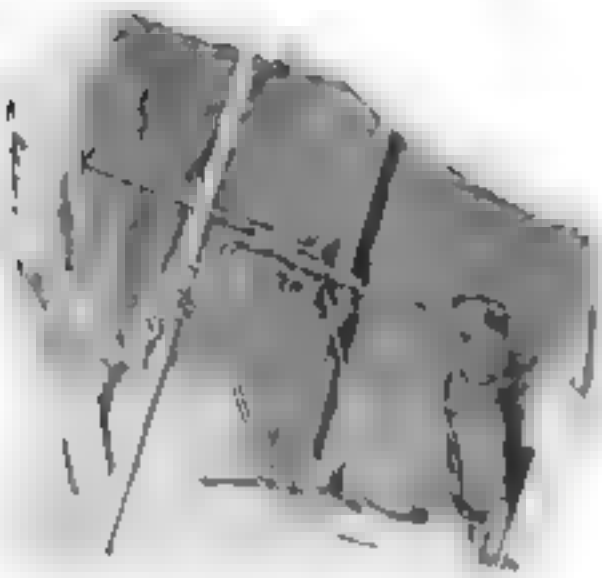
This happens when we use a circuit like that shown in Fig. 3. There is, however, another type of circuit which has become well known and which gives good results. This is the circuit which contains the so-called "blocking" condenser in the grid circuit. One form of this circuit is shown in Fig. 5. This circuit, which is also simple, differs from the previous one in that it contains the blocking condenser C_2 and shunt resistance r. When the grid becomes positive it attracts electrons and so becomes charged negatively. (See Fig. 6.) Since the grid is insulated this negative charge cannot leak off. During the next cycle of the incoming oscillations, when the grid becomes positive again, it attracts more electrons and becomes more negative. The negative charge on the grid decreases the plate current. If the grid is well insulated it will retain its negative charge even after the incoming oscillations have ceased. This is not what we want because we want the plate current to decrease every time the waves strike the antenna and increase again when they stop, so that we can get current pulses through the receiver. It is therefore necessary that the charge on the grid leak off between successive incoming waves. To accomplish this the grid condenser is shunted with a very high resistance

How detecting current varies with plate voltage, using the circuit of Fig. 3

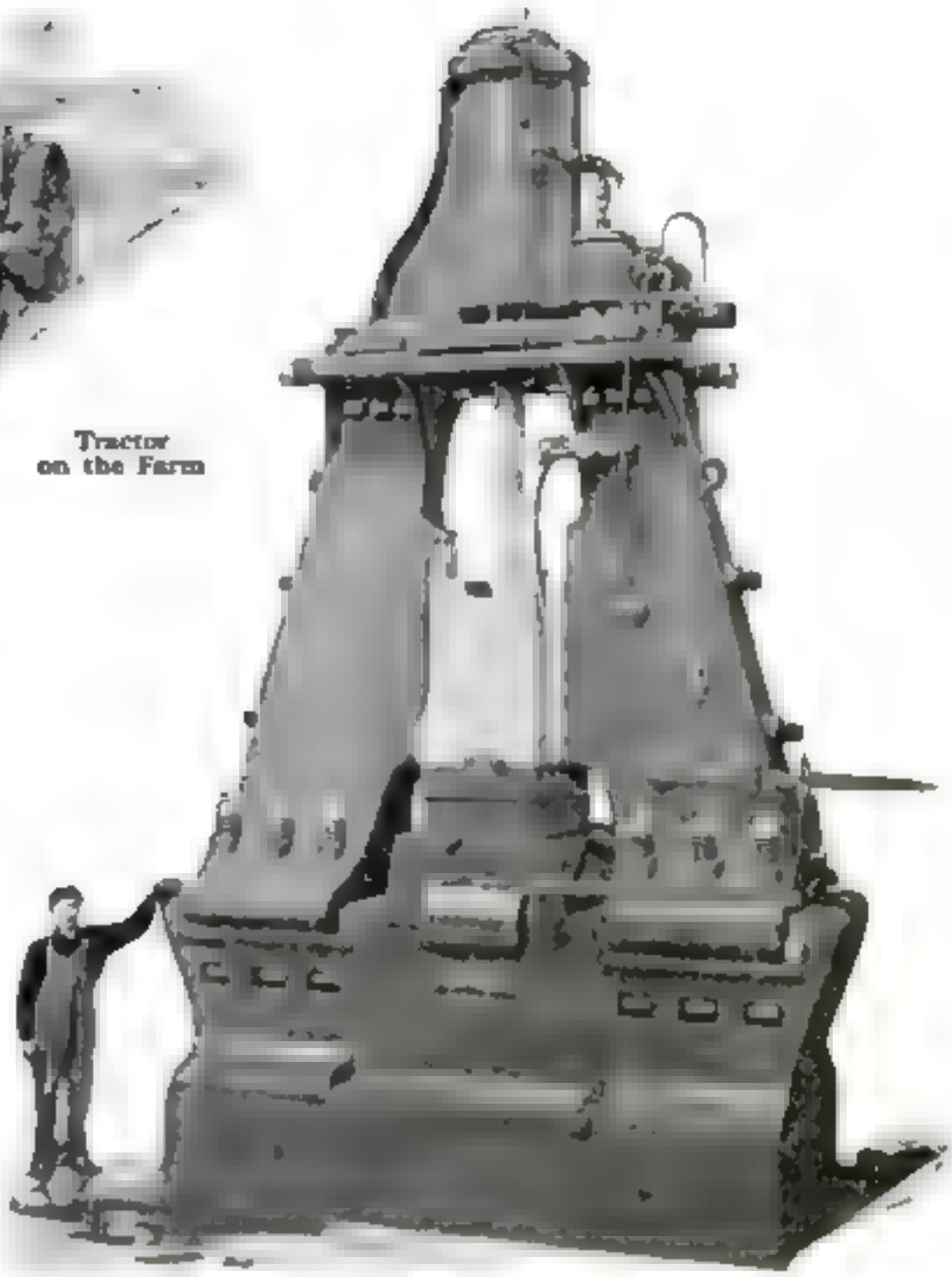


A receiving circuit having the "blocking" condenser in the grid circuit

Tractor on the Farm



Pneumatic Rock Drill in the Mine



The Drop Hammer in the Factory

Adding Machine in the Office

Washing Machine in the Home

Machinery and Inventive Genius

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r, which should be in the order of one or two million ohms. It is so high that the charge on the grid cannot leak off nearly as fast as it is built up by the incoming oscillations which, of course, pass through the condenser. But it can leak off before the next train of waves strikes the antenna. The plate current therefore varies as shown by the last curve of Fig. 6, that is, the oscillations become audible.

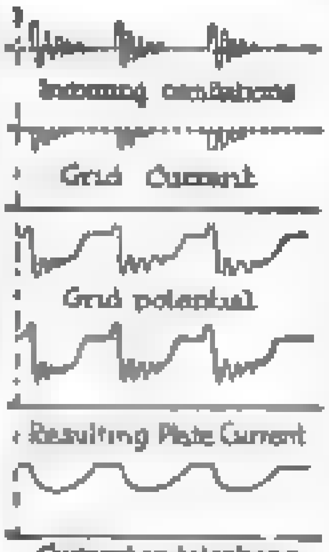
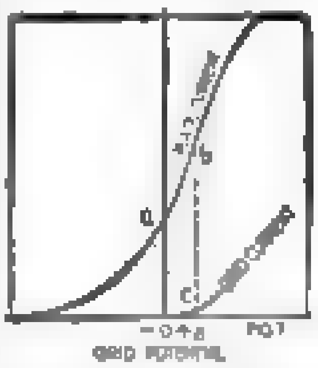


FIG. 6

How incoming oscillations are changed by the vacuum tube to currents the receivers can recognize

With this method of detecting it is desirable to have the grid current increase as rapidly as possible. Furthermore, it is desirable to operate on such a part of the plate current characteristic that a given change in the grid potential produces the largest possible change in the plate current. Both of these conditions can be secured by properly adjusting the plate and grid battery voltages. Fig. 7 shows the plate and grid currents for varying grid voltages. The curve *ab* is the same kind as that shown in Fig. 2. The curve *cc* shows the grid current for positive grid potentials. When the grid is negative with respect to the filament, electrons are repelled from the grid and the grid current is zero. But when the positive grid potential increases the grid current increases slowly at first and then more rapidly as indicated at *c*, that is, when the grid potential is equal to *od*. Now when the grid has this potential the plate current is given by the magnitude *db*, and here the plate current curve is quite steep, so that a small change in grid potential produces quite a large change in plate current. In using the tube in practice in the circuit shown in Fig. 6, it is necessary to know the value of the grid potential at which the grid current is steepest. It is also necessary to adjust the plate potential so that any variation from this grid potential produces the greatest possible change in plate current. This would need some adjustment. But we can obtain pretty nearly the best grid potential by simply connecting the grid circuit to the positive end of the filament, as shown in Fig. 5. When this is done the rest of the filament is negative with respect to the



When grid potentials change, plate and grid currents vary as indicated above

grid, the other end of the filament being negative with respect to the grid by an amount equal to the potential drop in the filament due to the heating current. With this connection it is then simply possible to adjust the plate potential until the signals heard in the telephone receiver are loudest. Usually it will be found within certain limits that the response in the receiver increases with increase in plate potential. This increase is at first rapid and then goes more slowly, so that there would not be much gain in making the plate potential too high. In the VT-1 type of tube, for example, the detecting action is about as good at a plate battery voltage of 20 volts as at 40.

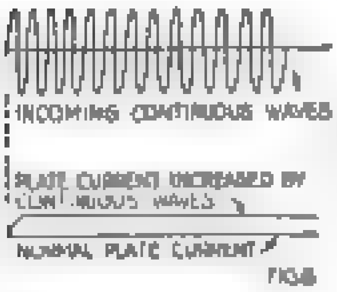


FIG 8

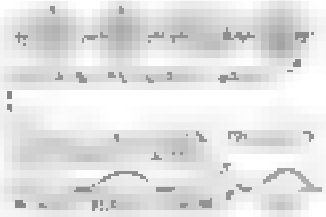
How the plate current is increased by continuous incoming waves

This is different from what takes place when using the tube without a grid condenser, where the detecting current, as was shown in connection with Fig. 4, again decreases when the plate potential becomes too high.

When the tube is used with a grid condenser the incoming signals are generally heard more strongly than when the grid condenser is not used. A capacity suitable for this purpose can easily be obtained. It should be about 150 to 500 micromicrofarads, with a leak resistance of about two million ohms bridged across the condenser. With a well evacuated tube there is really very little adjustment necessary. First set the filament current to the specified value. This should not be adjusted according to the brightness of the filament, but rather to the current that is specified, because tungsten filaments operate at bright incandescence while the coated type of filament operates at red heat. After the filament current is set the plate battery voltage can be adjusted until the signals are strongest. It may be possible that this may be further improved by adjusting the capacity of the grid condenser. Once these quantities are adjusted the tube circuit needs hardly any attention. All that is necessary then is to tune the input circuit to the frequency of the incoming waves.

An idea of the sensitiveness of the thermionic detector can be obtained from the following figures. In a good telephone receiver the least amount of power that it is necessary to expend in the receiver in order to get a signal that just barely enables one to discriminate between dots and dashes under normal conditions is a few micromicrowatts, that is, a few thousand-billionths of a watt. The power that a good thermionic detector will give in the form of audible current in the receiver when the strength of the incoming waves represents an input of

one volt on the grid, is about eight microwatts. This power is therefore still several million times as large as is necessary to give a readable signal. However, an input of one volt represents a very strong signal, and the power in the receiver drops off very rapidly as the incoming signal strength decreases. The smallest input voltage that still gives a readable signal is seldom less than a few hundredths of a volt—that is, when the grid condenser is not used. With the grid condenser the sensitiveness is greater.



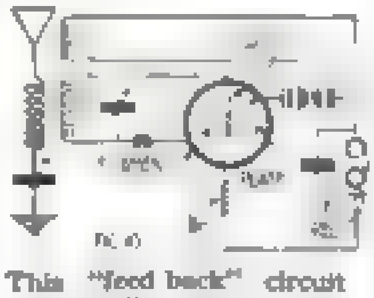
The effect of modulated waves on a tube's plate current

Now, there is a simple way in which the signal as heard in the telephone receiver can be strengthened. The two circuits shown in Figs. 3 and 5 can be used in radiotelephony. And if the voice coming on the waves is not strong enough it has to be amplified by connecting an amplifier tube to the output of the detector. This can, of course, also be done in radiotelegraphy, but in this case the above circuits can be used only when the incoming waves come from a spark transmitter or consist of oscillations that are interrupted at a frequency lying within the audible range. From the above explanation it will be clear that the waves striking the antenna cause a change in the plate current. If these waves are continuous there is produced simply an increase in plate current if the tube is used without a grid condenser and a decrease when used with a grid condenser. This change in the plate current will remain constant as long as the incoming waves remain constant (see Fig. 8), and such a change in the direct plate current will produce no audible note in the receiver connected in the plate circuit. But if the incoming oscillations are interrupted with a frequency lying within the audible range, the plate alternately increases and decreases with this frequency and a note is heard in the receiver, which lasts as long as the interrupted oscillations strike the antenna.

In the case of radiotelephony the oscillations are not interrupted but their intensity is increased and decreased according to the voice currents produced in the transmitter at the sending station. The waves are said to be modulated by the voice currents. In Fig. 9 is shown a radio-frequency wave that is modulated with an audio-frequency sine wave. The original sine wave is again obtained in the receiver placed in the plate circuit of the detector

When the incoming oscillations are continuous, not interrupted or modulated at an audio-frequency, they can also be made audible by making use of the phenomenon of beats. It is well known that if two tuning-forks are struck, that produce notes differ-

ing slightly in pitch or frequency, a note is heard that waxes and wanes at a frequency which is equal to the difference between the frequencies of the notes produced by the two forks separately. Now, suppose oscillations impressed on the input of the detector have a frequency of 300,000 cycles per second, and are continuous so that they produce no audible note in the receiver. In order to make the oscillations audible we can impress on the input of the tube another train of oscillations from a local generator. If the frequency of these oscillations is, say, 301,000 cycles per second, then a note will be heard in the receiver in the plate circuit, the frequency of which is the difference between the two frequencies impressed on the grid, namely one thousand cycles. This method of detection is known as the heterodyne method. It not only has the advantage of making the continuous oscillations audible, but it also increases the intensity of the note heard in the receiver. If the strength of the incoming oscillations corresponds to an input of e volts on the grid and that of the locally generated oscillations e_1 volts, then the detecting current, that is the audible current in the plate circuit, is proportional to the product ee_1. Hence by making the local oscillations strong the detecting current can be much increased, even though the incoming oscillations may be very weak.



This "feed back" circuit wonderfully improves an experimenter's receiving set

As a source of local oscillations a thermionic tube can be used, because it can easily be made to act as an oscillation generator. In fact it can do quite a few other things besides. This method then requires an addition in the form of a generator to the simple receiving circuit. But this is not necessary any longer, because a later development of the art has shown that it is possible to make the tube act as detector and an oscillation generator at the same time. The circuit with which this can be done is very simple and is shown in Fig. 10. It is known as the feed-back circuit, because by means of the coil L_1 part of the energy in the plate circuit is fed back to the input circuit LC. The tube acts as an amplifier, that is, for an amount of energy in the input circuit we obtain a larger amount in the plate circuit. If now part of this energy is returned to the input it will be further amplified, and so oscillations will build up until checked by the limitation of current that can flow through the tube. The frequency of the oscillations so formed depends on the frequency constants of the tube and its circuit. The feed-back coil L_1 can be of about the same value as L or even smaller, and should be so

ranged that the coupling between the two coils can easily be varied. This can be done conveniently by rotating the feed-back coil. When using this circuit it is necessary to insert the grid battery E_g so as to maintain the grid at a negative potential with respect to the filament. If this is not done the grid takes too much current and this reduces the sensitiveness of the device.

This circuit is very simple to operate. Once the plate voltage and filament current have been adjusted the tube can be left to itself. It is then merely necessary to tune in by means of the condenser C and adjust the coupling of the feed back coil. If the circuit does not work, it will usually be found that either the plate voltage is too low or the filament current too low. If the plate voltage is high enough a small increase in the filament current will usually set the tube operating.

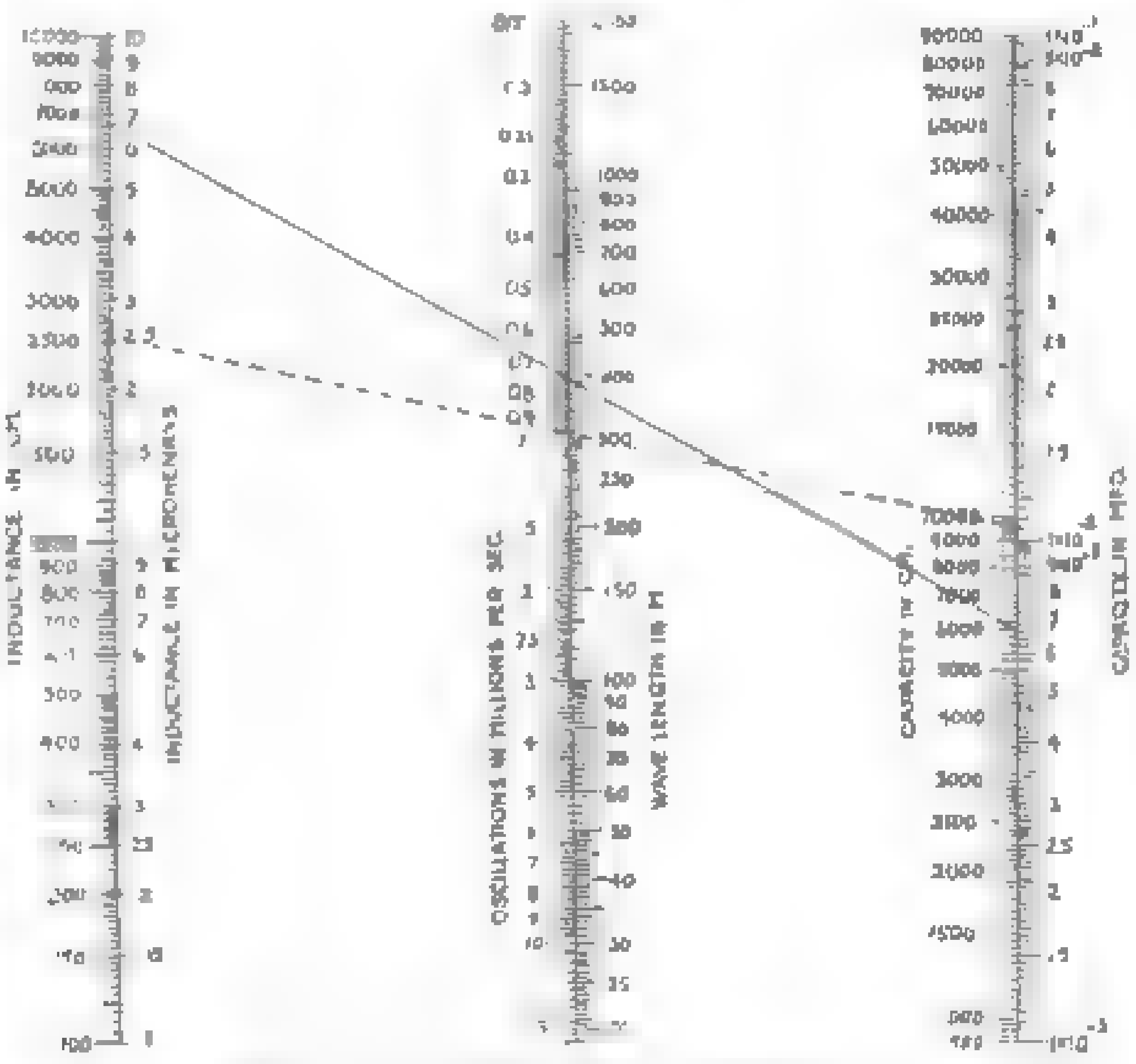
As in the case of heterodyne receiving, so with this simple circuit the sensitiveness of the tube can be greatly increased. With such a circuit it is possible to pick up telegraph messages coming from very considerable distances.

Find Wave-Lengths by Chart

IN any circuit containing capacity and inductance (that is, a condenser and a coil of wire of some form), it is usually very difficult to find the wave-length and natural frequency involved, the formulas for this being numerous.

Here, however, is a chart by which the values may be obtained almost at a glance. No matter whether the circuit involved be just an ordinary one around the laboratory, or whether it have within it an aerial and other radio apparatus, the chart will work as well. Few diagrams that the POPULAR SCIENCE MONTHLY could publish would be possessed of so much all-around usefulness to the radio student.

To use the diagram, merely lay a book-cover across it, or a sheet of paper, and use the book or paper's edge as a straight-edge to reach across between the figures in the three columns. If you haven't a book or paper, use a thread, or a piece of string. At any rate, the idea is merely to get a line across the columns connecting the values of capacity and inductance which the operator *already knows*. Then, where the line intersects the center column, the wave-length and frequency which the operator *desires* will be shown. Obviously, if the operator happens to possess the wave-length and the capacity of the circuit, instead of what he had before, and lays his straight-edge connecting these values on the center and right-hand columns, then the value of inductance necessary will be made plain where the straight edge intersects the left-hand column.



Given any two quantities about an aerial circuit, the other may be obtained from this table at a glance

So knowing any two values about

an oscillatory circuit, the third may be obtained from this simple diagram.

For example: Suppose that one knows in a given circuit the self-inductance is 6,800 cm., or 6.8 microhenrys. He therefore places one end of his straight-edge at this value in the left-hand column (see black line in the drawing). He also knows the capacity is 6,000 cm. The other end of the straight-edge or black line is thereupon placed at this 6,000 cm. value in the right-hand column. This makes the black line intersect the middle column at about 400 meters, the wave-length desired. So on with any other values of inductance and capacity.

This particular chart was worked out by a German officer, P. Luckey by name, early in 1917, and was captured by American forces. The idea is not particularly new, as there is one in the American book by Mauborgne entitled "Wavemeter in Wireless Telegraphy," and also in the book by Eccles on radio.

Control Your Filament with a Spool Rheostat

THE essentials for this rheostat are: One empty spool about 1¼ in. long; a ⅛-in. brass rod about 2½ in. long, threaded with 8-32 thread; two dry-battery binding-post caps with internal threads; a piece of 1/16-in. sheet

Spool rheostats serve excellently on receiving sets

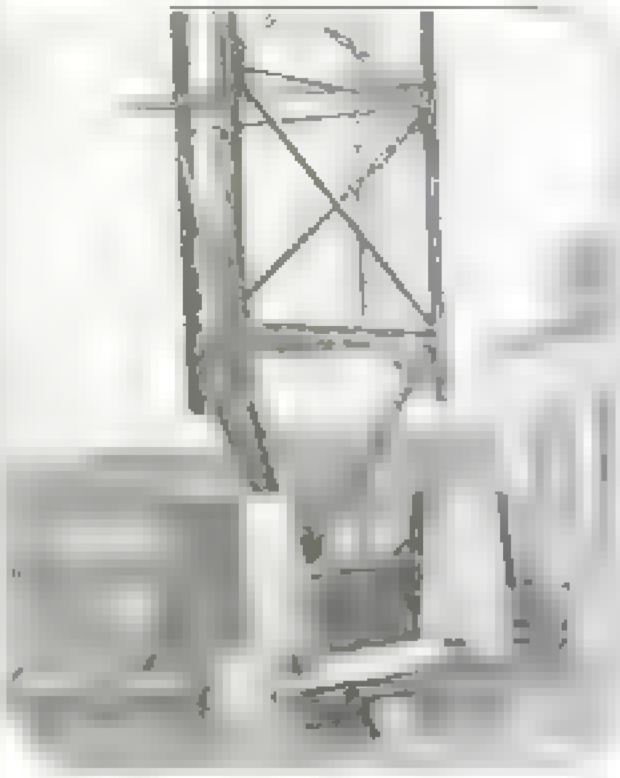
brass, some binding-posts, a knob, a pointer, and a scale.

The end-pieces for the spool are cut from the sheet brass. The back piece is fastened to one end of the spool with screws. A dry-battery binding-post cap is soldered over the middle hole in the front piece. A similar cap is soldered to one end of the brass rod. The rod is then screwed through the cap on the front piece, ready for use.

Enough pulverized carbon is put in the open end of the spool to fill it about one quarter full. The piston is then inserted and the front piece securely screwed to the spool. Three holes are drilled in the panel and the rheostat bolted to it. The knob pointer and scale may then be attached. Electrical connections are made to the front and back pieces. Screwing the knob in compresses the carbon, reducing the resistance; while screwing it out produces the opposite result.—HAROLD J. HASBROUCK, JR.

Supposing Back-Yard Aerials Were Really Large

THE great wireless masts, which sometimes rise to a height of 500 feet and more, present many mechanical difficulties. Although constructed



The ball-and-socket joint provides needed flexibility, allowing swaying

of open steel latticework, they are swayed back and forth by the wind, frequently swinging as much as eighteen inches from the perpendicular. The bases of the masts are therefore built upon the principle of the ball and socket. The base narrows to a point, or rather a ball, which is set in a steel socket firmly embedded in concrete. The mast is then braced by a series of steel ropes attached at various heights, which run to concrete anchorages surrounding the base. The tall structure may therefore swing far from the perpendicular without endangering it. The concrete base makes it possible to raise the entire structure on jacks when repairs are necessary.

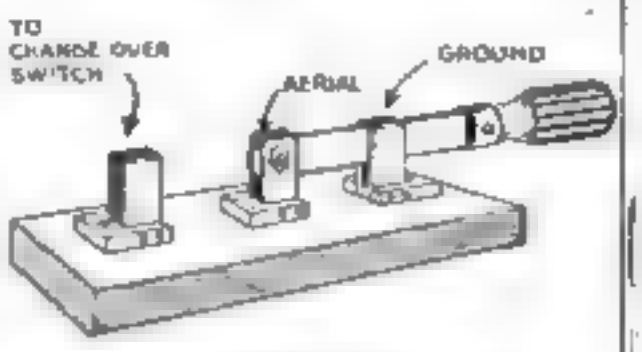
Concrete makes the anchorages firm

Winds and tall aerials are no friends

Owing to the fact that many farmers are changing to gasoline engines to run their pumps, it should be possible for numerous amateurs to secure old steel windmill towers as supports for their aerials. Often these towers are 70 or 80 feet high. Then if 20 or 30 feet of pipe were mounted on their tops, aerials of considerable height should result.

Close the Ground Switch and Avoid Lightning

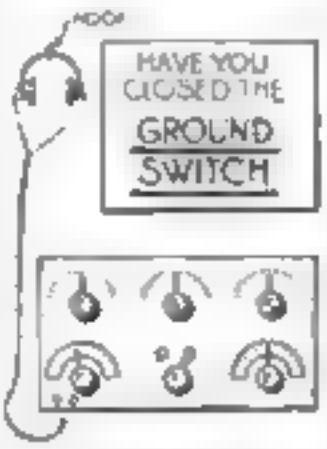
IN every radio installation there should be a ground switch installed at the point where the aerial enters the building. This may consist simply of a heavy single-pole, double-throw knife switch, the knife of which is connected to the aerial. The contacts, one at each end of the switch-block, are respectively connected one to



A ground switch should always be installed where aerials enter buildings

ground and the other to a change-over switch. This latter switch then permits either sending or receiving apparatus to be cut in on the aerial, according to the desires of the moment.

But the idea in the ground switch is that when the operator is not using his apparatus he may swing the knife of the switch over so that it comes in contact with the side that is grounded—in this way, in effect, running the aerial into the room and directly out again into the earth. This is a good idea, for the reason that the aerial is like Franklin's kite—it picks up lightning. Unless this ground switch is "closed"—that is, engaging the contact that is grounded—the lightning is liable to enter the room and damage the radio apparatus. So radio amateurs should always close the ground switch when leaving the apparatus, for a thunder shower may come up in their absence, and cause no end of damage. If the ground switch is locked with a padlock of some kind, it also prevents unauthorized persons from using the set, unless they disengage the wiring entirely from its accustomed positions.



A warning that helps to keep the ground switch closed

A radio student, Philip A. Wall, suggests that experimenters prepare a large sign, reading, as shown in the illustration: "Have you closed the ground switch?" If such a sign were mounted on the wall near the hook where the set-owner is accustomed to hang his receivers when through listening, it would serve as an effective reminder to close the switch. Older amateurs know these things already. The younger ones, however, need the admonition.

Navy Vacuum Tube Collection

THESE vacuum tube pictures we are able to present through the courtesy of Commander Hooper of the Navy. The collection was tested by Lieutenant W. A. Eaton, and Radio Aide Horle during the war. The radio student will find a study of the different types of great interest.—EDITOR.

Early Types

No.	Origin	Filament	Grid	Plate	Base	Remarks
[illegible]						

Improved Types

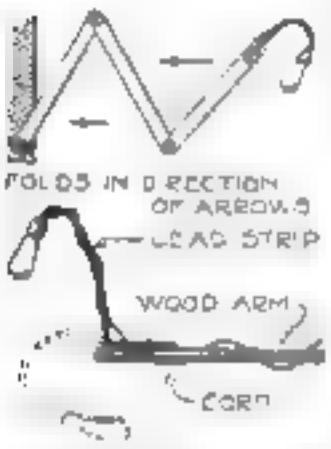
[illegible]						

Foreign and Uncommon American Tubes

[illegible]						

A Handy Electric Light for the Work-Bench

EVERY work-bench needs a good light, one which is adjustable and capable of being moved about from one end of the bench to the other. Swinging lights are usually in the way, and those upon tracks are liable to get out of adjustment.



Make your own bracket lamp for the work bench It will repay you by giving light where it is needed

Two folding brackets like those illustrated are used to advantage about the bench, for they fold back out of the way and permit the light to be raised or lowered at will.

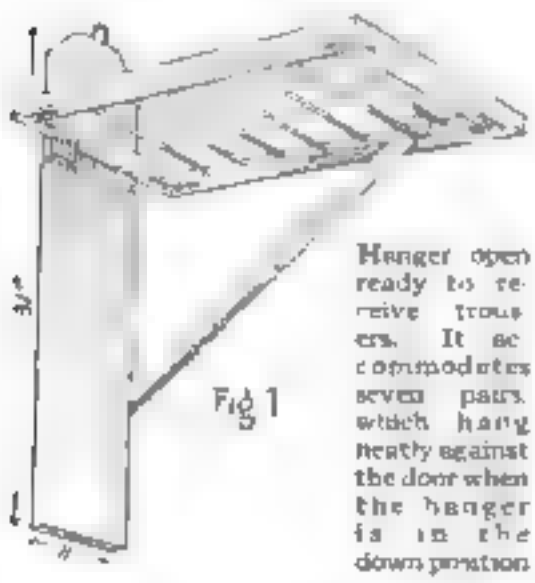
Cut out three sections of hard wood and fasten the ends together with bolts and washers. Make a joint just tight enough so the pieces will swing apart without binding too tight Bolt one end to a block at the rear of the bench so that will swing also.

Mount a strip of lead vertically on the front end about 15 in. long and attach the lamp to it. Use a flexible cord between it and the wall. The lead can be bent and straightened at will and thus lowers or raises the light By folding the bracket in or out the light can be set near the front or back of the bench or swung to either side. – L. B. ROBBINS.

Keep Your Trousers from Wrinkling in the Closet

THE most difficult garments to dispose of conveniently in the closet are the trousers.

The illustrations accompanying this article illustrate an ample home-made trouser hanger which will keep all the extra pairs of trousers in one place



Hanger open ready to receive trousers. It accommodates seven pairs which hang neatly against the door when the hanger is in the down position

and at the same time will preserve the creases and keep the garment hanging smooth and flat

The construction of the appliance is

so simple that anyone can make it at home by following the accompanying illustrations.

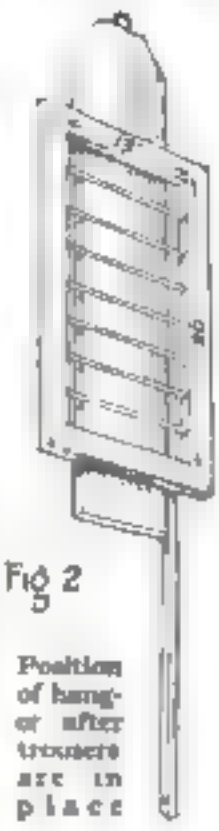


Fig 2

Position of hanger after trousers are in place

First procure a board 11 in. wide and 31 in. long, and after taking the corners of one end off as shown in Fig. 1, insert a large screw-eye in the end of the board

Then square a line across the same end of the board just 4 in. from the end. This is the line on which you will hinge the frame.

Make a mitered frame of wood 1¼ in. or 2 in. wide, just 13 in. by 20 in. inside measure. Before putting the frame together take the two long side pieces and placing them together with the inside edges up, divide the length into eight parts and with your square mark across both edges. They should measure just 2½ in. between marks.

The next step is to bore seven ½-in. holes, about half an inch deep in each piece, centered on these marks, and after cutting seven ½-in. dowel sticks to 14-in. lengths put the frame together, inserting the dowel sticks in the holes you have made

The corners of this frame are made rigid with four small metal right angle corner braces placed on the under side of the frame.

Procure two strong hinges and hinge the frame to the back board on the line you have made 4 in. from the end of the back board as shown in Fig. 1.

Arrange a brace to hold the frame at right angles with the hanging board as shown in Fig. 1. This brace is hinged to the edge of the back board with a screw and has a deep notch cut in the other end to receive the last of the cross sticks in the frame.

The method of using the appliance is to brace up the frame in a horizontal position, place the bottom ends of the trouser legs over one of the cross sticks, and pull down until the garment is just half over the stick; and so on until all of the cross sticks are filled, when the frame is dropped flat against the back board. In this position it will take but very little room in the closet.

In removing the trousers it is only necessary to lift the frame with one hand and pull the garment down off the cross stick.

If it is thought desirable an additional screw-eye may be placed in the lower end of the back board and a nail or screw inserted through the screw-eye will hold the contrivance firm against the wall.—MORTIMER V. TESSIER

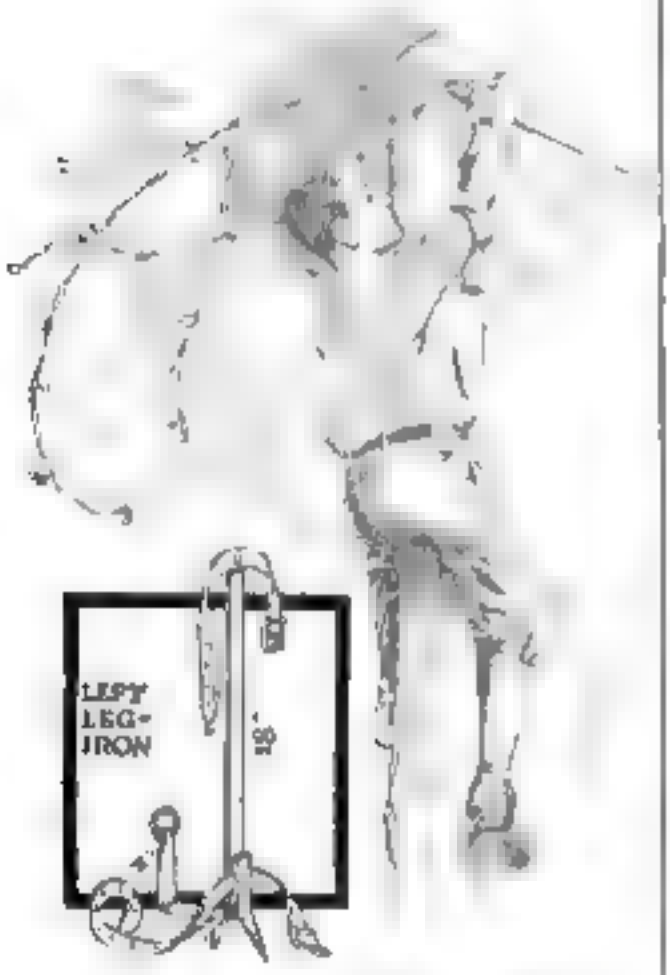
How to Make a Pair of Climbing Spurs

THE regulation lineman's climbers or spurs are somewhat expensive, but any boy may easily make a pair just as strong and equally as serviceable for about one third the cost.

Procure two pieces of common tire iron 27 in. long and 1½ in. wide—such as is used for buggy tires. Measure off 8 in. from one end and bend over at right angles, to make the foot-rest 4 in. wide, and the upturned part also 4 in. wide.

Now turn over one inch of the short upturned end and before closing, insert a 1-inch harness ring in the iron strap thus formed.

For the spurs, use two pieces of steel tire, about 6 in. long. Bend



Here is a pair of climbing spurs that will enable you to cut tree limbs, etc

at an angle of about 45 degrees and draw out to make a point. Drill two holes along the shanks of the spurs, and soudly attach by riveting. In doing this, use rivets of about 3 16 in. size and 1 in. long. Place a burr or washer between spur and leg iron before riveting together; this makes a slot for the foot strap.

The knee strap should be about 1½ in. wide, and is attached to the top of the leg-iron by either turning over the end, or by riveting. Be sure and place them on the same side as the spurs, however.

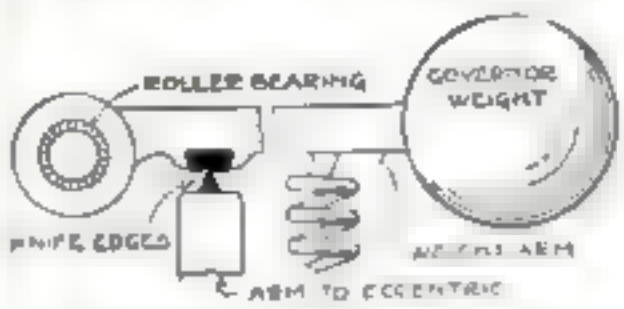
The foot-straps are attached by running the strap through the slot made by the burrs between the rivets, once around the ankle, thence through the ring and then buckled.

Any blacksmith can supply the material for this home-made climber and will drill the holes and supply the rivets, or make the whole thing for fifty or sixty cents.—STILLMAN TAYLOR.

Put Roller Bearings in the Governor Weight Arm

KNIFE edges are associated in our mind with scales, and roller bearings with fast running machinery of the lighter variety. But such anti-friction construction is proving a great aid in heavy machinery, as for instance in steam engine governor parts whose regulating ability must be of the most sensitive kind, though the parts themselves may weigh a ton or two and the engine develop hundreds or thousands of horsepower

The illustration shows a weight arm mounted upon roller bearings. The



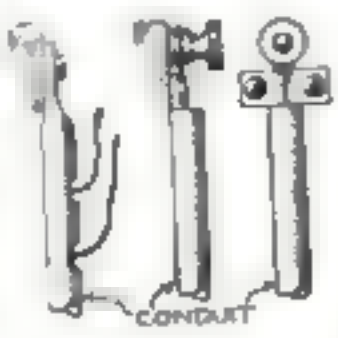
Adopt roller bearings to the weight arm of the governor and avoid friction and frequent repairs

pin about which this turns may be around ⅜ in. in diameter and the total movement at the pin may be only 1/16 in; but the arm moves more easily and readily than a plain pin in a plain hole, a construction that starts from a set position with a jerk.

The construction of the arm to the rod running to the eccentric is made by knife edge and seat. These are glass-hard pieces of tool steel. They also move readily from a dead position and with the slightest friction. An added advantage of the construction is cheapness of first cost, with long life and economical renewal. In the case of the knife edge held to its seat there is none of the looseness and pounding found with a pin-in-bearing construction the minute the fit wears beyond the bounds of a good running fit.—DONALD A. HAMPSON.

Running Wires through an Automobile Conduit

IT is impossible to be too careful about how ignition and other wires are run on an automobile, and if wiring is carefully done you will be much easier in your mind on the road. Wires carrying low-tension current are not heavily insulated. Ordinarily it is not necessary that they should be, so far as carrying the current is concerned. But it is the unexpected that happens,



To prevent those annoying short circuits run the ignition wires through conduits and eliminate the trouble

and protection of the wiring from outside injury cannot be too strongly urged.

It is a very good scheme to run such wires in a heavy woven tubular conduit, and not only does this protect, but it can also be used to support the wires and take the strain off the terminals.

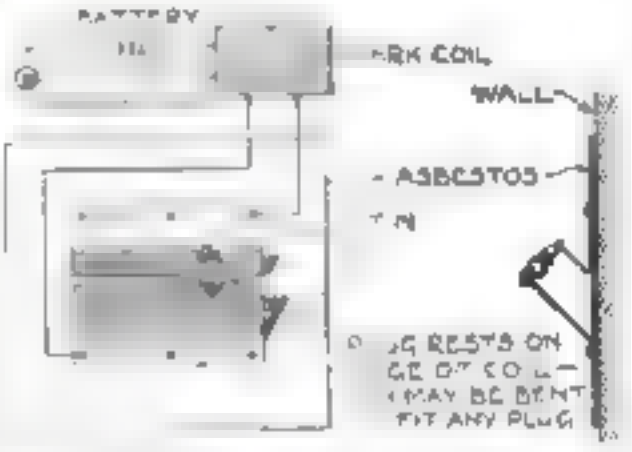
The illustration shows, in a suggestive way, how this can be done. Individual conditions will indicate the exact methods.—HOWARD GREENE.

How to Make a Simple Spark-Plug Tester

IF there is an old spark coil about, it may be transformed into an effective spark-plug tester, which is a very good thing to have about the garage or house.

The old coil is attached to the wall, and directly beneath it a sheet of asbestos is fastened with tacks. Two pieces of tin are procured, 6 inches long and 4 inches wide. One is bent into the shape of a fish-hook as shown at the right of the diagram. The other is bent into an obtuse angle.

These pieces of tin are screwed on to the asbestos sheet with screws smaller than the holes in the tin, and with insulating washers made from sheet



There are always two or three old spark plugs about the car. Test them at home then you won't get caught napping on the road

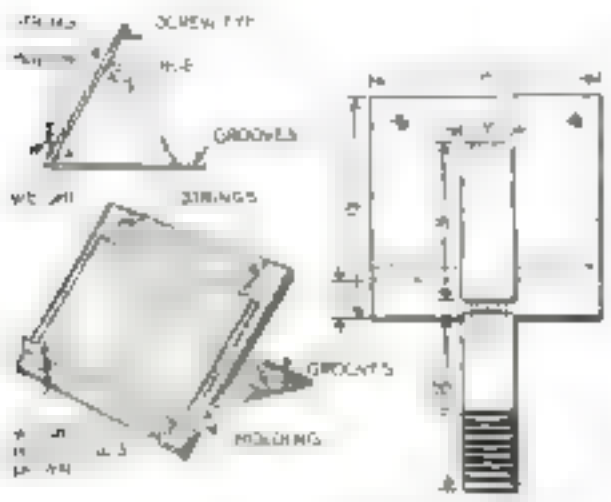
rubber between the tin and the screws. This is to keep the insulation perfect. The pieces of tin are arranged so that when they are in place and a spark-plug is laid upon their edges, they will come in contact with the plug at the top and the bottom below the porcelain insulation.

Three or four dry batteries should work the coil perfectly. Fasten them in some convenient place, and connect one wire from the battery to one of the binding posts of the primary, and the other to one connection of a push button as shown at the top of the diagram. Another wire is run from the other post of the switch to the other post of the primary, and the apparatus is complete.

A plug is tested by laying it on the edges of the tin and pressing the button. If the plug is functioning properly a spark will jump between the gaps.—DALE VAN HORN.

A Handy Book-Stand for the Sick-Room

A STRONG and handy adjustable book-stand may be made from four pieces of board picked up around the work-shop. The dimensions given in the diagram are for a book of



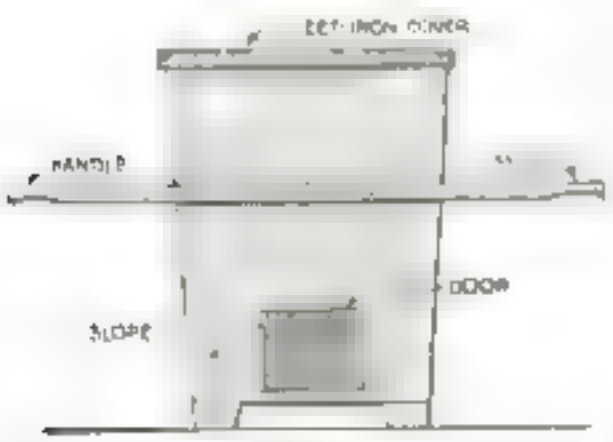
Adapted to the invalid as well as the lazy person, this stand holds the book in a readable position

ordinary size, but may easily be increased for larger books.

The drawing shows plainly how the stand may be tilted back to an angle to suit the reader. The pages are held down by strings fastened to screw-eyes on the back of the stand, in such a way that when the strings are laid across the book they will fall on the margin and not on the type. Weights are fastened on the strings to keep the pages flat. The book is held up by a molding nailed on the board.—M. TOCABEN.

Use Sand to Extinguish a Gasoline or Oil Fire

SAND may be stored in a wooden receptacle similar to that shown in the illustration, and is best applied to



Throw sand on that fire and save buying expensive extinguishing apparatus. A sweeping movement does the trick

the fire by means of a long-handled shovel.

The sand should be fairly dry and mixed with sodium bicarbonate, ten parts sand to one part sodium bicarbonate for the best results. This latter substance gives off a non-inflammable gas which forms an air-tight blanket that excludes the flame-feeding oxygen. ROY H. POSTON.

A Ten-Foot Camera to Make Portraits of Insects

WHO would think that a 10 ft. camera could take pictures perfect in every detail? That such is the case is proved by the accompanying illustrations. The camera consists of two 5 ft. parts fitted with light-tight joints. An excellent double anastigmat lens with a 2 in. aperture,

The camera is easily made as the illustration proves and the results secured are both instructive and interesting

suitable for a 4 by 5 camera is used, the lens being attached to one end of the camera and a ground glass to the other.

If a small insect such as a butterfly is placed about a foot from the lens, its image is thrown upon the ground glass twenty times enlarged. The focusing must be done very carefully, and for this reason the ground glass is taken out after the adjustments are made. The time of exposure in bright sunlight is from 1 to 1½ minutes.

Here is one of the pictures taken by the ten foot camera it shows the head of a butterfly greatly magnified

With a smaller lens the time of exposure must be longer.

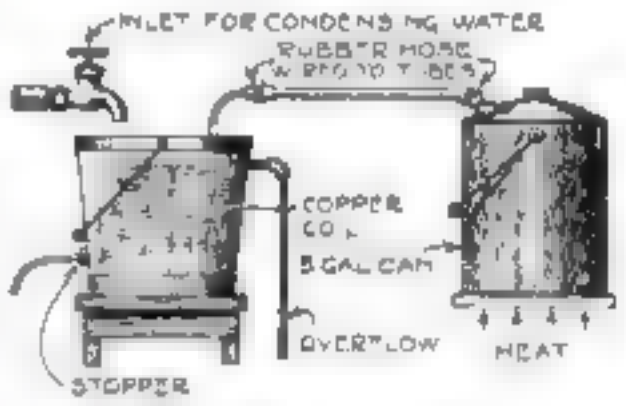
The diversity of form and the peculiar appearance of our smaller insect life is wonderful beyond description and the pains taken to produce their photographs is well worth while as well as instructive.—ERNEST BADE.

Distill Your Own Storage Battery Water

TO keep storage batteries in a healthy condition for maximum service pure water must be added at stated intervals, usually about once a week. By pure water is meant water reasonably free from mineral impurities which in time would accumulate in the bottom of the cells and impair the action of the battery. The three sources of pure water are rain water, melted artificial ice water and distilled water. The two former are in many cases hard to procure when most needed, but distilled water can be had at any time by means of a simple distilling arrangement herein described.

Distilling is accomplished by driving steam from a body of heated water through a tube sufficiently chilled to condense the steam back into fluid form. The solids are left behind and pure water is the result.

A five gallon kerosene can makes an admirable boiler. Punch a very small hole through the filler cap to allow for evaporation. Some steam will escape but will not interfere with the operation.



Distilled water is absolutely necessary to storage batteries. Here's a way to manufacture it cheaply

Bend a spiral coil out of about ten feet of ½-in. copper tubing so it will fit easily into a common wooden water bucket.

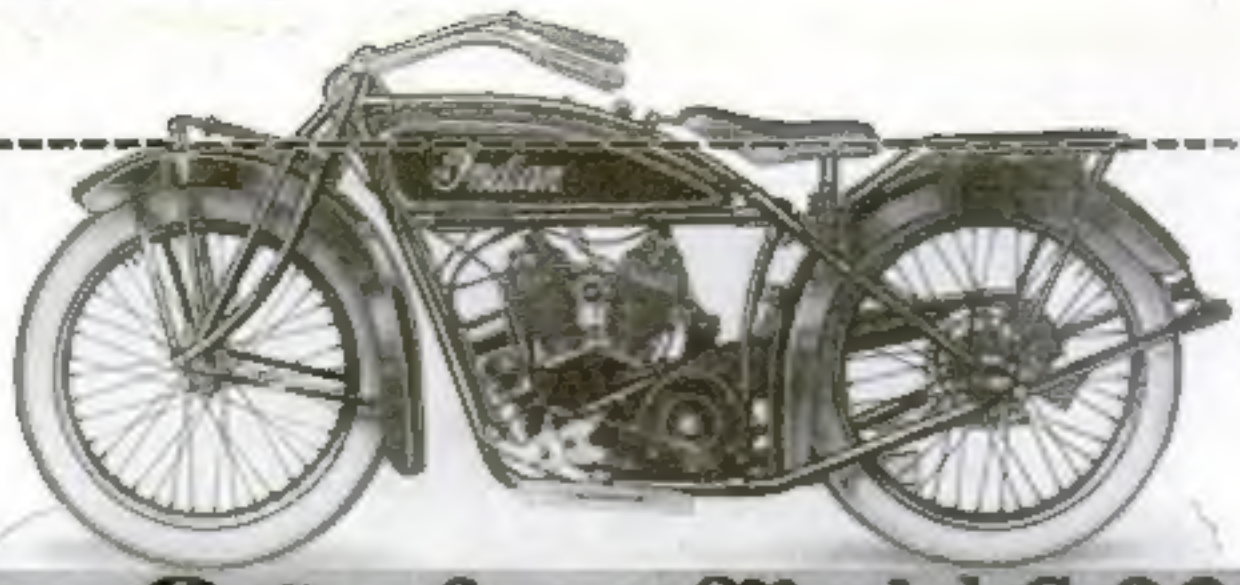
Bore a large hole in the side of the bucket near the bottom and fit a wooden stopper to it. The lower end of the coil passes through a snug fitting hole in this stopper and turns downward to discharge its contents. By painting the part of the tubing enclosed by the stopper and the outside of the stopper itself with roofing paint and then forcing both in place a tight joint may be made.

Connect the upper end of the coil and the spout on the boiler with a piece of steam hose or heavy rubber tubing. Wire on each end to make steam tight.

Provide running cold water for the bucket and pierce the side above the top coil for an overflow. By regulating the flow of water in the bucket the level can be kept above the coils without overflowing. But be sure to keep enough running in so the contents will not become warm.

Fill the boiler three quarters full and boil it just hard enough to throw off sufficient steam without creating pressure. This will fill the coils with steam which will quickly condense as it passes down the cold coils and will emerge as pure water in the jar below the discharge.

Keep the jar well corked when full to prevent contamination from the air—L. B. ROBBINS.



The remarkable balance and ease of operation of the INDIAN Scout is a result of its low saddle position, its low center of gravity and the scientifically correct distribution of weight. Compare the INDIAN Scout saddle-line with that of any other machine.

Indian Scout Model G-20

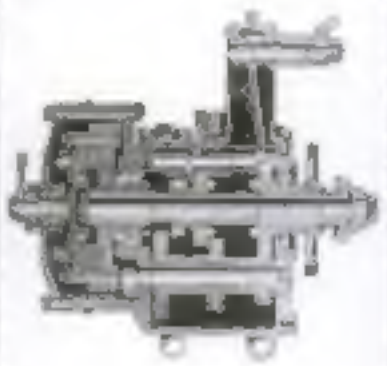
Simplest yet most dependable motor built. High efficiency type, with side by side valves. 2½ inch bore and 3½ inch stroke, giving a piston displacement of 30.38 cubic inches. Roller bearings in main shafts and connecting rods. Most economical and remarkably accessible. It actually delivers 11½ h. p. Extremely flexible; rides steadily at slow pace in high gear and picks up to 55 miles per hour in 30 seconds.

FOR years the motorcycling public has demanded a "perfect middleweight solo mount." This demand has now been met in the latest triumph of the "Factory behind the INDIAN"—the new INDIAN Scout Model G-20. Though this model is 100 pounds lighter than the far-famed Powerplus, nothing has been sacrificed in the way of strength or sturdiness or mechanical perfection.

INDIAN Scout innovations in design and construction are many. Note carefully the illustrations and descriptions of its motor and transmission, given on the left and right of this page. Eminent engineers and motorcycle experts have pronounced the INDIAN Scout the "marvel of motorcycle engineering." Its balance and ease of operation are remarkable. It is the most economically operated machine. 75 miles on a gallon of gasoline! And it's the cleanest and most silent of all motorcycles. Gives the greatest comfort in riding, and yields all the speed and power you'll ever want.

Call on your INDIAN dealer and look over his complete stock of 1920 INDIAN Models. Get a practical demonstration of the model that best suits your personal requirements. Don't delay—the demand from all sections of the country is tremendous. Write for FREE Catalog.

HENDEE MANUFACTURING CO.
DEPT. 38
Springfield, Mass.
The Largest Motorcycle Manufacturer in the World



In unit with motor and clutch. Alloy steel gears and shafts of more than ample strength for all requirements. Three speeds operating progressively. Main shaft on generous ball-bearings and countershaft on bronze bushings. Multiple disk clutch running in oil bath; positive action. Independently accessible.

Indian Motocycle

For Sale by Dealers Everywhere

FOLDING CORONA—
AS SIMPLE AS CLOSING A BOOK

Until the advent of Corona, manufacturers struggled in vain to produce a writing machine combining the efficiency of the standard office typewriter with the compactness necessary to portability.

It seemed necessary either to sacrifice features essential to the convenience of the operator or to adopt mechanical designs which would reduce the speed of operation or lower the character of the work.

The difficult problem is solved in Corona by using a folding carriage. This expedient makes possible a machine which, while very compact when folded, is of proper balance and proportions when ready for use. It also permits the use of a type bar of standard length.

THE SECRET OF THE FOLDING TYPEWRITER

Corona's folding feature makes possible the construction of a machine large enough for all practical purposes, yet small enough to be portable.

CORONA

The Personal Writing Machine

fold it up-take it with you-typewrite anywhere

PAINTED FOR LIGGETT & MYERS TOBACCO CO.

To be fashionable a cigarette need not be expensive. In fact, at most exclusive clubs and smart hotels the preference is for a relatively inexpensive cigarette—Fatima.

Of course, it is only logical that Fatima should appeal to the discriminating smoker, for, not only does Fatima's "just enough-Turkish" blend lack the oily heaviness of the expensive straight Turkish cigarette, but it retains, at the same time, a smoothness and richness not to be found in blends less fortunately balanced.

Liggett & Myers Tobacco Co.

FATIMA

A Sensible Cigarette